NUCLEAR SCIENCE ABSTRACTS

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ERRATA

NSA, Vol. 8, No. 11, p.430. In abstract 3594, the sixth line reads: 503 ± 8 kev (0.11 ± 0.02%); it should read 503 ± 8 kev (0.11 ± 0.02‰).

NSA, Vol. 8, No. 8, p. Index-6. In Numerical Index of Reports, report AECU-2383, delete availability information.

NSA, Vol. 8, No. 15, p.562. In abstract 4709, the journal reference should be Phys. Rev. 94, 1080-1(1954).

NSA, Vol, 7, No. 24A, p.1095. In Numerical Index of Reports, report KAPL-305, delete availability information.

NSA, Vol. 7, No. 24A, p.1069. In Numerical Index of Reports, report AERE-G/M-68, delete availability information.

NSA, Vol. 7, No. 6A, p.211. In abstract 1737, Report KLI-1425 should be K-1135; KLI-1425.

NUCLEAR SCIENCE ABSTRACTS

Vol. 8 Sept. 30, 1954 No. 18A

BIOLOGY AND MEDICINE

5464

Brookhaven National Lab.

ABNORMAL AND PATHOLOGICAL PLANT GROWTH. REPORT OF SYMPOSIUM HELD AUGUST 3 TO 5, 1953. BROOKHAVEN SYMPOSIA IN BIOLOGY NO. 6. 310p. (BNL-258)

Current work on factors affecting abnormal growths in plants was discussed at this symposium. Topics discussed included: substances involved in normal growth and differentiation of plants; the use of in vitro cultures in the investigation of growth and differentiation in vascular plants; abnormal plant growth; genetic tumors in Nicotiana hybrids; nutrition and diseased plant growths; mechanisms of crown-gall induction; the origin of crown-gall tumor cells; experimental inhibition of the growth of plant tumors; size and shape of wound-tumor virus; virus induced abnormalities; nutritional aspects of virus-tumor growth; studies on growth and regeneration in gametophytes and sporophytes of Gymnosperms; morphogenesis of the leguminous root nodule; the nature of the stimulus in the Solidago gall induced by the larvae of Gnorimoschema Gallaesolidaginis; and aberrant growth in plants induced by ionizing radiation. (C.H.)

5465

Oak Ridge Inst. of Nuclear Studies

QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1954. 22p. Contract AT-40-1-Gen-33. (ORO-128)

Abstracts of published papers, papers accepted for publication, and papers presented at meetings by personnel of the Medical Division are included in this report. (C.H.)

5466

Radiation Lab., Univ. of Calif., Berkeley

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER, 1953. Apr. 1954. 62p. Contract W-7405-eng-48. (UCRL-2553)

Cell-free extracts of dividing yeast cells were observed to exhibit several new macromolecular components not present in resisting yeast cells. The appearance of the new macromolecular components was shown to be related to the condition of cell division by following the appearance of the new components as cells in a starved culture were induced to divide by the addition of an ingredient containing utilizable nitrogen. Preliminary studies of the stability of the macromolecular components under various conditions of extraction were made. Irradiation with x rays was found to have no influence on the stability of the microsomes or on the ability of cells to produce the new components when induced to divide. Data are presented on the tissue distribution of $Eu^{152-154}$, Lu^{177}, Th^{227}, and Fe^{59} in rats. The histopathological effects of At in rats were studied, and results are compared with the effects of I^{131}. Data are included on the radiation chemistry of acetic acid exposed to cyclotron beam intensities as low as 0.010 μa, the effects of dissolved oxygen in irradiation of aqueous solutions of acetic acid, and the radiation chemistry of aqueous glycine solutions. (For preceding period see UCRL-2418.) (C.H.)

5467

PHOTOSYNTHESIS. Rufus Lumry (Univ. of Minnesota, Minneapolis) John D. Spikes and Henry Eyring (Univ. of Utah, Salt Lake City). Ann. Rev. Plant Physiol. 5, 271-340 (1954). (cf. NSA 7-3339).

New findings from studies of the photochemistry of photosynthetic pigments, chloroplast structure and composition, energy transfer mechanisms, the Hill reaction and its relation to photosynthesis, the quantum requirements for photosynthesis, and related subjects are reviewed. 401 references. (C.H.)

5468

EFFECTS OF CYSTEAMINE AND CYSTEINE ON CARDIAC OUTPUT AND OXYGEN CONTENT OF VENOUS BLOOD. Robert Charlier (Univ. of Liège and Société des Laboratoires Labaz, Brussels, Belgium). Proc. Soc. Exptl. Biol. Med. 86, 290-3(1954) June.

Data are submitted concerning the changes in cardiac output, systolic output, pulmonary ventilation, oxygen consumption, and oxygen content of the mixed venous blood of the right heart following intravenous administration in anesthetized dogs of cysteine and cysteamine. (auth)

AEROSOLS

5469

Air Cleaning Lab., Harvard Univ. School of Public Health

AIR CLEANING STUDIES. PROGRESS REPORT FOR JULY 1, 1952 TO JUNE 30, 1953. Melvin W. First, Leslie Silverman, Richard Dennis, Charles Billings, August T. Rossano, Edward Conners, Richard Coleman, and Philip Drinker. Aug. 5, 1954. 37p. Contract AT(30-1)-841. (NYO-1591)

Progress is reported in studies of the principles of cloth filtration and applications in wet dust collection; studies of the efficiency of fibrous media as air filters; and studies of the role of electrostatic charge in aerosol filtration. (For preceding period see NYO-1586.) (C.H.)

RADIATION EFFECTS

5470

School of Aviation Medicine

CHANGES IN THE PROTEOLYTIC AND ANTIPROTEOLYTIC ACTIVITY OF THE BLOOD SERUM IN MAN AND ANIMALS FOLLOWING EXPOSURE TO X-RAYS. (PROJECT NO. 21-3501-0004, REPORT NO. 4). Kenneth L. Burdon and Rufus K. Guthrie. Baylor Univ. Coll. of Medicine and School of Aviation Medicine. Feb. 1954. 28p. (NP-5257)

An investigation revealed that a profound and prolonged disturbance in the normal levels of serum proteolytic and antiproteolytic activity occurs after exposure to x radiation in both humans and guinea pigs. Indications were that the degree of this disturbance was related to the intensity of the radiation. The possible significance of these findings is discussed, in relation to mechanisms responsible for a number of phenomena, including the relative protection afforded against radiation damage by preradiation injection of various humoral agents, the beneficial effects of suitable doses of x radiation in allergic and infectious states, and the alterations in the normal bactericidal power of the blood following exposures to whole-body x radiation. (auth)

5471
Naval Radiological Defense Lab.
SPLEEN DESOXYRIBONUCLEIC ACID CONTENT AS AN INDEX OF RECOVERY IN X-IRRADIATED MICE INJECTED WITH SPLEEN HOMOGENATE. L. J. Cole and M. E. Ellis. June 2, 1954. 29p. (USNRDL-438)

The effect of acute lethal whole-body x irradiation (740 r) on the desoxyribonucleic acid (DNA) content of the spleen, and its modification by post-irradiation treatment with homologous mouse spleen homogenate has been investigated using a new modification of the Schneider procedure for chemical determination of tissue DNA. At 24 hours post-irradiation, the DNA content per spleen decreased from a normal value of 1963 ± 76 μg (in nonirradiated mice) to 463 ± 70 μg, and this low level persisted in the control, irradiated mice until death (9th day). The DNA concentration was likewise depressed from normal values of 19.7 ± 0.35 μg/mg to levels of 8 μg/mg until death. A single post-irradiation injection of spleen homogenate into the irradiated mice elicited a profound regeneration of the spleen in terms of DNA content concomitant with survival of these animals. The recovery phenomenon is characterized by a reversal of the depression in total DNA content per spleen, which is, however, not manifest until the 6th day; by day 9 the total DNA values exceed that of normal mice. Further evidence for the relationship between spleen DNA content and recovery was provided by DNA analyses on splenectomized mice which had received spleen homogenate treatment. The magnitude of the response in DNA content per spleen, both during involution and in the recovery phase, was greater by factors of 2 and 3, respectively, than the spleen weight response. Recovery of the spleen DNA in x-irradiated mice receiving spleen homogenate precedes that of peripheral leucocyte count and that of body weight. The results indicate that the spleen DNA level provides a sensitive biochemical index of recovery following x irradiation exposure. It is proposed that this endpoint be employed as a biochemical assay for the spleen radiation protection factor. (auth)

5472
THE RELATIONSHIP BETWEEN THE HAIR GROWTH CYCLE AND THE RESPONSE OF MOUSE SKIN TO X-IRRADIATION. Thomas S. Argyris (Brown Univ., Providence, R. I.). Am. J. Anatomy 94, 439-71(1954) May.

5473
VARIATIONS IN THE MITOCHONDRIAL FRACTION OF THE RAT LIVER AFTER TOTAL AND LIVER FIELD IRRADIATION (1000 r). H. Ryser, H. Aebi, and A. Zuppinger (Univ. of Bern, Switzerland). Experientia 10, 304-5 (1954) July 15. (In German)

A study was made of the influence of local (liver field) and total irradiation (1,000 r) on the enzymatic activity of isolated liver mitochondria from adult rats. While the succinodehydrogenase acitity remains unaltered, the oxidation of pyruvate—as well as the structural stability of the mitochondria—are found to be reduced, entailing a decrease in the oxidative phosphorylation. These variations remain the same even after total or local irradiation. (auth)

5474
THE RELATION BETWEEN X-RAY DOSAGE AND THE FREQUENCY OF SIMULATED HEALING OF CHROMOSOME BREAKAGES IN DROSOPHILA MELANOGASTER FEMALES. Irwin H. Herskowitz (Indiana Univ., Bloomington). Proc. Natl. Acad. Sci. U. S. 40, 576-85(1954) July.

Female Drosophila were treated with two different dosages of x radiation, and the number of exceptional F_1 individuals of appropriate types were determined. Analysis of the data indicates that all the exceptional flies may be considered to carry gross chromosomal rearrangements, and that gross rearrangements occur more frequently after x irradiation of oöcytes than after x irradiation of oörgonia. (C.H.)

5475
CARCINOGENIC ACTIVITY OF RADIOACTIVE PHOSPHORUS. Simon Koletsky and James H. Christie (Western Reserve Univ. School of Medicine, Cleveland, Ohio). Proc. Soc. Exptl. Biol. Med. 86, 266-8(1954) June.

Single doses of radioactive phosphorus, administered internally to rats in amounts of from 1 to 3.5 μc/gram body weight, proved carcinogenic. Osteogenic sarcoma and carcinoma of the face were produced. The incidence of neoplasms ranged from 22 to 50%. The latent period of tumor development was lengthened with smaller doses of P^{32}. Amounts of P^{32} less than 1 μc/gram body weight failed to induce neoplasms. (auth)

5476
OBSERVATIONS ON EFFECTS OF X-IRRADIATION ON ACHROMOBACTER FISCHERII. R. D. Higginbotham and John Z. Bowers (Univ. of Utah Coll. of Medicine, Salt Lake City.) Proc. Soc. Exptl. Biol. Med. 86, 303-5(1954) June.

It has been observed that the reproductive mechanism of A. fischerii is more sensitive to x irradiation at all measured dosage levels than is the luminescent system of this organism. These findings indicate that cells sterilized by x irradiation are capable of metabolic activity for a measurable length of time after exposure. (auth)

RADIATION HAZARDS AND PROTECTION

5477
New York Operations Office, AEC
DECONTAMINATION OF BUILDINGS USED FOR PROCESSING ALPHA EMITTERS. Paul B. Klevin, William B. Harris, and Hanson I. Blatz. Apr. 29, 1954. 23p., 1 illus. (NYO-4600)

Obsolescence of the original Atomic Energy Commission uranium processing plants has resulted in the dismantling of several of the early units and their replacement by new facilities. In the course of dismantling, it was necessary that contamination by the radioactive uranium and radium be removed from buildings and equipment so that they would be acceptable to other commercial enterprises. Levels are proposed which it is believed would permit such sale or transfer. Data are presented showing the levels of contamination before and after decontamination. Decontamination procedures are discussed and cost figures presented. (auth)

5478
THE PROTECTIVE ACTION OF GLUCOSAMINE AGAINST THE LETHAL EFFECT OF TOTAL X RADIATION IN THE MOUSE. Jean-François Duplan and Albert-Jean Rosenberg. Compt. rend. 239, 116-17(1954) July 5. (In French).

Results are reported from studies of the protective effects of glucosamine administered to rats before exposure to total-body irradiation. Modifications in response due to variations in dose of glucosamine, irradiation dose, and exposure time are attributed to the inactivation of certain enzymes by exposure to the radiation. (C.H.)

RADIATION SICKNESS

5479
EFFECT OF CHLORPROMAZINE ON EMESIS AFTER RADIATION. Herman I. Chinn and George L. Sheldon (USAF School of Aviation Medicine, Randolph Field, Texas). Proc. Soc. Exptl. Biol. Med. 86, 293-5(1954) June.

Chlorpromazine-(dimethylamino-1-n-propyl-3)—N—(2-chloro)—phenothiazine HCl in doses of 10 mg/kg in-

jected subcutaneously protected dogs against vomiting after 800 r x radiation. Injections of 5 mg/kg were ineffective as were 10 mg/kg prepared from solutions allowed to stand for 2 hours at room temperature before injection. Cysteinamine (200 mg intravenously) had no or questionable protection whether given before, during, or after radiation. Increased survival time was noted with both chlorpromazine and cysteinamine. The mechanism of protection is discussed. (auth)

RADIOGRAPHY

5480

Naval Ordnance Lab.

GAMMA RAY SOURCES AND TECHNIQUES FOR GAMMA RAY RADIOGRAPHY. J. J. Hirschfield, D. T. O'Connor, and D. Polansky. Feb. 26, 1953. 87p. (NAVORD-2666; AD-19207)

A general review of radioisotopes used as radiation sources for industrial radiography is given along with production methods, measurement units, standards, and nomenclature commonly associated with their use. The specific characteristics of commercially available radiation sources are discussed as well as elements expected to be available in the near future. Particular attention has been paid to the characteristics of various isotopes which determine their suitability for specific types of radiographic inspection. Complete information for the purpose of obtaining optimum radiographs for various object thicknesses and materials is provided. Information is likewise provided for the safe handling, storage, and shipping of radioisotopes of various energies. (NOL abst.)

RADIOTHERAPY

5481

Oak Ridge Inst. of Nuclear Studies

MEDICAL DIVISION QUARTERLY PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1954. TELETHERAPY DESIGN PROBLEMS III. Consists in part of the PROCEEDINGS OF THE THIRD INDUSTRIAL CONFERENCE ON TELETHERAPY. 105p. Contract AT-40-1-Gen-33. (ORO-127)

Design problems, cost factors, availability of Co^{60}, requirements for protection, and miscellaneous factors affecting the design and performance of a Co^{60} teletherapy irradiation unit are discussed. Results are included from a study of the use of marble as area shielding. (C.H.)

5482

Oak Ridge Inst. of Nuclear Studies

MEDICAL DIVISION QUARTERLY PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1954, SUPPLEMENT. TELETHERAPY DESIGN PROBLEMS III. Constitutes the minutes of the PROCEEDINGS OF THE THIRD INDUSTRIAL CONFERENCE ON TELETHERAPY. Marshall Brucer, J. H. Harmon, and Elizabeth B. Anderson, eds. 71p. Contract AT-40-1-Gen-33. (ORO-127(suppl.))

Topics discussed at this conference included: the cost of radiation in hospitals; current problems of Co^{60} production; problems of source strength, calibration and loading; the AEC allocation policy for teletherapy source units; data a manufacturer must supply the radiologist; shipping containers; instrumentation; new sources for teleradiation; the development of the atomic energy industry; and design of an irradiator containing a Tm source. (C.H.)

TOXICOLOGY STUDIES

5483

Los Alamos Scientific Lab.

EXPERIMENTAL ADMINISTRATION OF ETHYLENEDIAMINETETRAACETIC ACID IN PLUTONIUM POISONING. Harry Foreman, Los Alamos Scientific Lab. and Philip A. Fuqua and William D. Norwood, Hanford Works. [1954] 13p. Contract [W-7405-eng-36]. (AECU-2923)

The metabolic fate and behavior of ingested Pu in experimental animals and the therapeutic effects of Ca ethylenediaminetetraacetic acid in Pu poisoning are discussed. (C.H.)

TRACER APPLICATIONS

5484

Atomic Energy Medical Research Project, Western Reserve Univ.

THE USE OF P^{32} IN THE IDENTIFICATION OF INTRAOCULAR TUMORS. J. S. Krohmer, C. I. Thomas, J. P. Storaasli, and Hymer L. Friedell. July 23, 1954. 19p. Contract W-31-109-eng-78. (NYO-4961)

Results are presented from studies of the measurement of the differential uptake of P^{32} in 63 cases of various intraocular lesions. Data indicate that P^{32} uptake is a valuable diagnostic tool when used as an adjunct to careful clinical evaluation of suspected eye tumors. (C.H.)

5485

Radiation Lab., Univ. of Calif., Berkeley

THE METABOLISM OF CHYLE CHOLESTEROL IN THE RAT. Max W. Biggs and Alexander V. Nichols. May 12, 1954. 20p. Contract W-7405-eng-48. (UCRL-2586)

Observations on the metabolism of chyle cholesterol in the rat show that exogenous cholesterol entering the systemic circulation in chyle exists in lipoproteins of low density (including chylomicrons) migrating with a high S_f rate (i.e., > 400) in the ultracentrifuge. Following entry into the systemic circulation these molecules are rapidly removed from the plasma. This clearing of serum chyle cholesterol is a tissue phenomenon, the liver being the predominant site. Within the liver the chyle cholesterol esters are at least partially hydrolyzed; hydrolysis apparently does not occur in the plasma to any appreciable extent. After its entry into the liver exogenous cholesterol, if normally metabolized, presumably mixes with and becomes indistinguishable from cholesterol produced by endogenous synthesis. (auth)

5486

Radiation Lab., Univ. of Calif., Berkeley

PHOTOPERIODISM AND PHOTOSYNTHETIC CO_2 ASSIMILATION. L. Norris and M. Calvin. June 1954. 12p Contract W-7405-eng-48. (UCRL-2612)

Data are presented on the fixation of radioactive CO_2 by short- and long-day Kalanchoe leaves during various stages of development. The effect of photoperiodism on photosynthesis and initiation of metabolic changes is discussed. (C.H.)

5487

Atomic Energy Project, Univ. of Rochester

STUDIES ON THE BIOSYNTHESIS OF HEMIN. 1. BONE MARROW. J. E. Richmond and K. Salomon. June 18, 1954. 95p. Contract W-7401-eng-49. (UR-319)

A method is described for determining the ability of bone marrow preparations to incorporate the alpha carbon atom of glycine into hemin. Methods for the isolation and purification of hemin are also presented. (auth)

5488

ACCUMULATION OF ASTATINE^{211} BY THYROID GLAND IN MAN. Joseph G. Hamilton, Patricia W. Durbin, and Marshall W. Parrott (Univ. of California, Berkeley and San Francisco). Proc. Soc. Exptl. Biol. Med. 86, 366-9 (1954) June.

Accumulation of At^{211} by thyroid gland in patients suffering from various disorders of that organ has been demonstrated. Accumulation of At^{211} by thyroid glands of these

patients appears to be relatively higher than has been observed in experiments employing rats. There may be a correlation between the uptake of At^{211} and stable iodine in thyroid tissue. One patient with papillary adenocarcinoma showed no discernible accumulation of At^{211} in metastases present in cervical lymph nodes. (cf. UCRL-2604.) (auth)

5489

EFFECT OF PRETREATMENT WITH PROPYL THIOURACIL ON ACCUMULATION OF ASTATINE^{211} BY THYROID GLAND OF THE RAT. Patricia W. Durbin, Joseph G. Hamilton, and Marshall W. Parrott (Univ. of California, Berkeley and San Francisco). Proc. Soc. Exptl. Biol Med. 86, 369-71(1954) June.

A study has been made of the accumulation of I^{131} and At^{211} in normal and propyl thiouracil-treated rats. A very marked enhancement of the accumulation of At^{211} in the thyroid gland has been observed following administration of propyl thiouracil. This is in contrast to the diminution of the uptake of I^{131} by the thyroid glands of the rats receiving propyl thiouracil. (auth)

WASTE DISPOSAL

5490

Sanitary Engineering Research Lab., Univ. of Calif., Berkeley
REMOVAL OF RADIOISOTOPES BY SEWAGE TREATMENT PROCESSES. PROGRESS REPORT NO. 3 COVERING PERIOD JUNE 1, 1953 TO MAY 31, 1954. BIOLOGICAL TREATMENT OF RADIOACTIVE WASTES. Gerhard Klein, Arnold E. Greenberg, and Warren J. Kaufman. June 30, 1954. 67p. Contract AT-11-GEN-10. (AECU-2824)

The application of aerobic methods of biological sewage treatment to the treatment of radioactive wastes was investigated. Results are reported from studies of the removal of mixed fission products and radioactive Sr from both natural domestic sewage and from a synthetic substrate, the efficiency of the activated sludge and trickling filter processes for the removal of fission products, and the P requirements of algal-bacterial systems in a symbiotic relationship. (For preceding period see AECU-2730.) (C.H.)

CHEMISTRY

5491

Raw Materials Development Lab., American Cyanamid Co., Atomic Energy Div.
THE CHEMISTRY OF VANADIUM. A SUMMARY OF THE NON-PROJECT LITERATURE THROUGH NOVEMBER 1952. Andrew J. Frank. June 25, 1954. 40p. Contract AT(49-1)-533. (ACCO-49)

The nonproject literature concerning the chemistry of vanadium has been summarized through November 1952. The report is presented in terms of iso- and heteropoly vanadates and cationic forms of pentavalent vanadium, complexes of di-, tri-, and pentavalent vanadium, and oxidation potentials of various vanadium systems. A bibliography of 93 references is included. (auth)

5492

Atomic Energy Research Establishment, Harwell, Berks (England)
PREPARATION OF ANHYDROUS TUNGSTEN HEXACHLORIDE. C. E. C. Richards and M. L. Smith. Feb. 17, 1954. 7p. (AERE-GP/M-167)

A method is described for preparing 500-gram batches of anhydrous tungsten hexachloride suitable as source material in ion arcs. The process involves the direct chlorination of tungsten freshly reduced from tungsten trioxide and the collection of the product in such a way as to minimize hydrolysis by atmospheric water vapor. The material obtained by this process was 100% volatile in vacuo at 150°C. (auth)

5493

Technical Information Div., Library of Congress
REPORTS ON BORON COMPOUNDS. (ABSTRACT BULLETIN U3). July 19, 1954. 10p. (NP-5022)

5494

Tufts Coll.
THE HEATS OF FORMATION OF LITHIUM, SODIUM, AND POTASSIUM HYDRIDES. Charles E. Messer and Ludwig G. Fasolino. Mar. 15, 1954. 33p. Contract AT(30-1)-1410. (NYO-3956)

The heats of formation of the hydrides of lithium, sodium, and potassium at 25°C were measured by means of the differences between the heat of reaction of each hydride with water and the heat of reaction of the corresponding metal with water. The reactions were carried out in a specially designed bomb enclosed in an adiabatic calorimeter jacket. The heats of formation found, at constant pressure at 25°C, are:

LiH: $\Delta H = -21.34 \pm 0.09$ kcal/mole
NaH: $\Delta H = -15.69 \pm 0.12$ kcal/mole
KH: $\Delta H = -15.16 \pm 0.11$ kcal/mole

The methods of preparation of the hydride samples and their analyses for purity are given. (auth)

5495

Tufts Coll.
A SURVEY REPORT ON LITHIUM HYDRIDE. Thomas R. P. Gibb, Jr. and C. E. Messer. May 2, 1954. 38p. Contract AT(30-1)-1410. (NYO-3957)

The physical and chemical properties of lithium hydride are described, based on available unclassified literature and on the author's own data. The history, preparation, thermal dissociation, corrosive character, utilization, analysis, handling and fabrication are discussed briefly. Some elementary considerations on the properties of containers are presented. Lithium deuteride is compared with the hydride. Consideration is given to practical matters as well as to theory. Where possible, data from the literature is presented critically. (auth)

5496

Oak Ridge National Lab.
THE HYDROGEN ELECTRODE-SILVER CHLORIDE ELECTRODE SYSTEM AT HIGH TEMPERATURES AND PRESSURES. M. H. Lietzke. July 30, 1954. 9p. Contract W-7405-eng-26. (ORNL-1741)

A knowledge of the behavior of the hydrogen electrode at high temperatures and pressures will ultimately afford a means of measuring the pH of aqueous solutions above 100°C. In the present paper it is shown how theoretical curves can be plotted demonstrating the behavior of the hydrogen electrode-silver chloride electrode system at temperatures up to 250°C and pressures up to 40 atmospheres. The agreement between calculated potentials, which are based on extrapolation of data obtained at lower temperatures, and experimental data obtained directly at the higher temperatures is shown and discussed. A mechanism is proposed to account for deviations between the calculated and experimental values at the higher temperatures and pressures. (auth)

5497

ON THE ELECTROLYSIS OF POTASSIUM–SODIUM ALLOYS. Robert Kremann and Rudolf Gruber von Rehenburg. Translated from Z. physik. Chem. 110, 559-71(1924). 8p. (AEC-tr-1845)

5498

DEPENDENCE OF THE BASE EQUILIBRIUM IN PERMUTITE

ON THE CONCENTRATION OF THE SURROUNDING SOLUTION. Translated by I. A. Warheit from Z. Elektrochem. 28, 85-9(1922). 12p. (AEC-tr-1940)

5499

DIELECTRIC PROPERTIES OF RARE-METAL OXIDES. Shigeyuki Nagasawa. Translated from J. Electrochem. Soc. Japan 18, 158-60(1950). 8p. (AEC-tr-1943)

The dielectric properties of ZrO_2, Ta_2O_5, BeO, CeO_2, La_2O_3, and ThO_2 were determined. The measurements were made on powder compacts, powder to which paraffin insulating oil was added, and sintered, pressure-molded powders. The results are tabulated. (J.S.R.)

5500

A COMPARISON OF THE PHOTOCHEMICAL PROPERTIES OF CHLOROPHYLL, PHEOPHYTIN, PHTHALOCYANIN AND ITS MAGNESIUM COMPLEX. V. B. Evstigneev and V. A. Gavrilova. Translated from Doklady Akad. Nauk S.S.S.R. 74, 781-3(1950). 5p. (UCRL-Trans-109; AEC-tr-1217)

The role of photochemical oxidation and reduction reactions of chlorophyll, pheophytin, and phthalocyanin and its magnesium complex on the rate of photosynthesis is discussed. Data are included which indicate that the presence of magnesium in chlorophyll and magnesium phthalocyanin molecules increases their rate of photooxidation as compared with their analogues which do not contain magnesium, whereas the rate of photoreduction is higher in compounds lacking magnesium. (C.H.)

5501

COMPLEXES OF ALKALINE EARTH CATIONS INCLUDING RADIUM WITH AMINO ACIDS AND RELATED COMPOUNDS. Jack Schubert (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 76, 3442-4(1954) July 5.

The interactions of Ca, Sr, Ba, and Ra with amino acids and related compounds were investigated for the most part at ionic strength of 0.16 and pH 7.2 to 7.3. All of the complexes were of the 1:1 type. The results of the study are summarized. (J.S.R.)

5502

THE AMALGAM PARTITION METHOD FOR THE DETERMINATION OF IONIC FREE ENERGIES IN NON-AQUEOUS SOLUTIONS. K. Schug and Harold L. Friedman (Univ. of Southern California, Los Angeles). J. Am. Chem. Soc. 76, 3609-10(1954) July 5.

The standard free energies of formation of ions in non-aqueous solution may be determined by measuring the interchange of two metals between the essentially metallic state in an amalgam stage and an ionic state in electrolytic solution. Preliminary results of the application of this method to the alkali metal ions in liquid ammonia solution are presented. (J.S.R.)

5503

SOME ASPECTS OF ISOTOPIC EXCHANGE. Rolfe H. Herber (Massachusetts Inst. of Tech., Cambridge). J. Chem. Educ. 31, 359-61(1954) July.

General principles of isotopic exchange investigations are discussed, including methods for calculation of the rate and activation energy of the exchange reaction. (A.G.W.)

5504

THEORY OF THERMAL DIFFUSION IN LIQUIDS AND THE USE OF PRESSURE TO INVESTIGATE THE THEORY. W. M. Rutherford and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys. 22, 1157-65(1954) July.

A theory of thermal diffusion in liquids is presented which involves a molecular interpretation due to Denbigh of the results of the thermodynamics of irreversible processes in terms of regular solution theory and a correction for differences in shape and size of the molecules. Thermal diffusion measurements have been made to 10,000 atmospheres pressure on a series of binary mixtures in a single-stage system. The results indicate that the theory is satisfactory. (auth)

5505

THERMAL DIFFUSION IN BINARY LIQUID MIXTURES OF MOLECULES OF SIMPLE SYMMETRY. R. L. Saxton, E. L. Dougherty, and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys. 22, 1166-8(1954) July.

A single-stage two-cell apparatus for measuring thermal diffusion in liquid mixtures has been developed. Thermal diffusion measurements are presented for a series of binary mixtures of molecules of simple symmetry over a range of temperature from 5 to 55°C. The theory presented in a previous paper (see preceding abstract) applies quite satisfactorily. The results indicate that the proposed measure of the cohesive energy

$$H_1 = \left(T\frac{\partial p}{\partial T}\right)_1\left(V - T\frac{\partial V}{\partial T}\right)_1,$$

gives reasonably quantitative results. (auth)

5506

THE EFFECT OF RING SUBSTITUENTS ON THE ISOTOPE EFFECTS IN REACTIONS OF CARBONYL-C^{14} ESTERS AND KETONES. Gus A. Ropp and Vernon F. Raaen (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 22, 1223-7 (1954) July.

The variations of the isotope fractionation factor k_{14}/k_{12} with changes in ring substituents, reaction temperature, solvent, concentration, and the alcohol group were studied for the saponification of ethyl benzoates (α-carbon-14). The variations of the k_{14}/k_{12} ratio with changes in temperature and ring substituents were studied for the formation of the 2,4-dinitrophenylhydrazones of acetophenones (α-carbon-14). (auth)

5507

KINETICS OF THE REACTION OF HYDROGEN WITH ZIRCONIUM. Jack Belle, B. B. Cleland, and M. W. Mallett (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 101, 211-14(1954) May.

The rate of reaction of hydrogen with high-purity zirconium was determined for the temperature range of 250 to 425°C at 1 atm. pressure. The reaction was found to follow a parabolic law, and the parabolic rate constant in $(ml/cm^2)^2$ per second was calculated to be $k = 2.3 \times 10^5 \exp(-17{,}200/RT)$, where $17{,}200 \pm 200$ cal/mole is the activation energy for the reaction. (auth)

5508

MECHANISM OF THE REACTION OF HYDROGEN WITH ZIRCONIUM. I. ROLE OF OXIDE FILMS, PRETREATMENTS, AND OCCLUDED GASES. E. A. Gulbransen and K. F. Andrew (Westinghouse Research Labs., East Pittsburgh, Penna.). J. Electrochem. Soc. 101, 348-53(1954) July.

Experiments were made on the rate of reaction of high-purity zirconium with pure hydrogen using a sensitive microbalance method and an all glass and ceramic vacuum system to minimize contamination. The effect of a preliminary vacuum heating cycle on rate of reaction with hydrogen at 150 to 700°C. Samples having the room-temperature oxide present showed only a slow rate of reaction, while samples heated to 700°C for one hour showed a rate of reaction 7700 times as great. Results also showed that the oxide film was effectively removed by heating in a vacuum for one hour at 500°C. A study was made of the thickness and nature of the oxide film. Thus, the film formed in air at room temperature was more resistant to hydrogen attack than thicker oxides formed at higher temperatures. Studies on the effect of small quantities of

oxygen and nitrogen in solid solution indicate only minor effects. Results suggest that considerable revision is necessary in concepts of the mechanism of the hydrogen reaction on metals. (auth)

5509
THE DIFFUSION COEFFICIENTS OF THE ALKALI METAL CHLORIDES AND POTASSIUM AND SILVER NITRATES IN DILUTE AQUEOUS SOLUTIONS AT 25°. Herbert S. Harned (Yale Univ., New Haven, Conn.) Proc. Natl. Acad. Sci. U. S. 40, 551-6(1954) July.

5510
THE EFFECT OF PARTICLE SIZE ON THE HEAT CAPACITY OF TITANIUM DIOXIDE. J. S. Dugdale, J. A. Morrison, and D. Patterson (National Research Labs., Ottawa, Canada). Proc. Roy. Soc. (London) A224, 228-35(1954) June 22.

The heat capacities of four samples of titanium dioxide, differing in particle size, have been measured in the temperature range 12 to 270°K in order to determine the effect of particle size on the specific heat. Contrary to the prediction of existing theories, no effect attributable to a change in particle size has been found in the low-temperature region. On the other hand, above 50°K a pronounced particle-size effect is evident which may be accounted for qualitatively as an effect on the optical modes of vibration of the solid. The complexity of the titanium dioxide crystal structure precludes any quantitative theoretical calculations. (auth)

5511
QUALITATIVE THEORY OF ELECTRON-TRANSFER MECHANISM Frederick R. Duke (Iowa State Coll., Ames). Record Chem. Progr. (Kresge-Hooker Sci. Lib.) 15, No. 2, 55-9(1954).

Different theories of the electron-transfer mechanism in oxidation-reduction reactions are discussed. The theories postulate an intermediate compound or an electron jump from reductant to oxidant. (J.S.R.)

ANALYTICAL PROCEDURES

5512
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ANALYSIS OF THORIUM–ALUMINUM ALLOYS. G. W. C. Milner and J. L. Woodhead. Apr. 8, 1954. 11p. (AERE-C/R-1400)

A procedure is described for the analysis of thorium-aluminum alloys containing up to 80% of aluminum. It is based on the separation of the thorium by extracting a nitric-perchloric acid solution of the sample, containing added calcium nitrate, with mesityl oxide. The thorium is back-extracted from the combined organic layers into water and finally determined volumetrically with ethylenediaminetetraacetic acid. The aluminum is recovered from the aqueous sample solution after the mesityl oxide extractions by precipitation as its insoluble benzoate. The aluminum content of this precipitate is also determined volumetrically with ethylenediaminetetraacetic acid. (auth)

5513
Atomic Energy Research Establishment, Harwell, Berks (England)
SORTING COAL AND SHALE BY SCATTERING OF GAMMA-RAYS. PRELIMINARY TESTS. J. L. Putman and E. W. Solomon. Mar. 11, 1954. 20p. (AERE-I/R-1407)

A quick and reliable method for distinguishing coal from shale was sought which would be independent of size and shape. Gamma scattering experiments were undertaken, using Co^{60}–small-angle scattering and Tm^{170} large-angle and back-scattering techniques. Small-angle scattering was found unsatisfactory as an analytical method, owing to the low γ energies required for sufficient scattering differences and consequent attenuation of the γ rays. The back-scattering technique was more promising, although some inaccuracy was noted in the analysis of marginal (middling) samples. (K.S.)

5514
Argonne National Lab.
REVISED RADIOCHEMICAL IODINE ANALYTICAL PROCEDURE. Elton H. Turk. July 1954. 12p. Contract W-31-109-eng-38. (ANL-5271)

A revised radiochemical iodine analytical procedure has been developed which will separate iodine activities from other mixed fission activities with a decontamination of 10^5 or more. Data are presented which establishes the precision of the method at ±2.6 per cent based on ten samples. The revised procedure utilizes the volatility of iodine to separate it from the other fission products except ruthenium. Ruthenium is removed by several solvent extractions of the iodine using carbon tetrachloride. A method for detecting ruthenium contamination in the radiochemical iodine samples is presented. (auth)

5515
North American Aviation, Inc.
RAPID SPOT TESTS FOR THE IDENTIFICATION OF BIPHENYL, o-, m-, AND p-TERPHENYL AND CERTAIN OTHER POLYPHENYLS. L. Silverman and W. Bradshaw. July 15, 1954. 22p. Contract AT-11-1-GEN-8. (NAA-SR-996)

Using formaldehyde-sulfuric acid reagent as a spot test reagent, the lower molecular weight polyphenyls, biphenyl, ortho-, meta- and para-terphenyls are identified by color formation in cyclohexane solutions. These lower polyphenyls cannot be differentiated in their chloroform or carbon tetrachloride solutions. Slight selectivity was observed for the higher polyphenyls when dissolved in cyclohexane, and none at all when the solute was dissolved in chloroform. An evident application for these spot tests lies in identifications after preliminary chromatographic separation of mixtures of polyphenyls. The spot tests may be checked by absorption spectroscopy. As little as 2 micrograms of biphenyl or of the individual terphenyls may be detected. (auth)

5516
Analytical Chemistry Research Lab., Univ. of Texas
SPECTROPHOTOMETRIC QUANTITATIVE DETERMINATION OF THE PLATINUM METALS. FINAL REPORT COVERING THE PERIOD JULY 1, 1950 TO JUNE 30, 1954. Gilbert H. Ayres. July 1954. 118p. Contract AT(40-1)-1037. (ORO-129)

Spectrophotometric methods for the determination of reaction stoichiometry are discussed. Findings are summarized from studies of methods for the spectrophotometric quantitative determination of Pt, Rh, Os, Ru, Ir, and Pd, and from spectrophotometric studies of systems containing these metals. (C.H.)

5517
Tour, Sam, and Co., Inc.
RESEARCH AND DEVELOPMENT OF METHODS OF CHEMICAL ANALYSIS FOR TITANIUM METAL AND ALLOYS. FINAL TECHNICAL REPORT. Henry Suss, Gregory Pantchenko, and Anna Aronson. May 12, 1954. 141p. Contract DA-30-069-ORD-1114. (WAL-401/48/A-36)

Methods of chemical determination of C, N, Fe, Cr, Mn, Al, Mo, V, Mg, W, chloride, Si, Ni, Co, Cu, Zr, Sn, Nb, Ta, Be, Th, B, Na, P, S, Ti, Ca, Pb, and Ag in Ti and Ti alloys are described and evaluated. (For preceding report in series see NP-4503.) (J.A.G.)

5518
COLORIMETRIC DETERMINATION OF NIOBIUM BY MOLYBDENUM BLUE METHOD. George Norwitz and

Maurice Codell (Pitman-Dunn Labs., Philadelphia). Anal. Chem. 26, 1230-4(1954) July.

The procedure described is based on the addition of sodium hydrogen phosphate and ammonium molybdate to the dissolved sample, the destruction of the phosphomolybdate color with H_2SO_4, the treatment of the solution with stannous chloride, and measurement of the molybdenum blue color due to the niobiophosphomolybdate complex with a spectrophotometer. Possible interferences and the effects of amounts of reagents and time intervals between addition of reagents are discussed. (A.G.W.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5519

HEAVY WATER. A REVIEW OF PROCESSES AND PLANTS FOR LARGE-SCALE PRODUCTION. Patrick J. Selak and Joseph Finke. Chem. Eng. Progr. 50, 221-9(1954) May.

Plants and processes for production of tonnage quantities of heavy water are reviewed from the standpoint of flowsheet, process engineering, description of existing plants, and plant performance. 11 references. (L.T.W.)

5520

A THERMAL METHOD FOR CONCENTRATING HEAVY WATER. E. Cerrai, C. Marchetti, R. Renzoni, L. Roseo, M. Silvestri, and S. Villani (Laboratori C.I.S.E., Milan, Italy). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 271-80(1954).

A separating element is described which utilizes the temperature dependence of the deuterium-exchange constants in hydrogen–water systems. An ideal cascade with these elements is also examined, and the possible energy consumption is estimated. Some experimental results are also given for a laboratory unit. (auth)

FLUORINE AND FLUORINE COMPOUNDS

5521

HEATS OF FORMATION OF GASEOUS FLUORO- AND FLUOROCHLORO-CARBONS. F. W. Kirkbride and F. G. Davidson (Imperial Chemical Industries, Ltd., Widnes, England). Nature 174, 79-80(1954) July 10.

Heats of formation have been determined for CF_4, CF_3Cl, CF_2Cl_2, $CFCl_3$, C_2F_6, $(CF_2Cl)_2$, C_2F_4, and CF_2:CFCl. (L.T.W.)

5522

THE ABSORPTION SPECTRUM OF GASEOUS ALUMINIUM MONOFLUORIDE IN THE SCHUMANN REGION. R. F. Barrow and H. C. Rowlinson (Univ. of Oxford, England). Proc. Roy. Soc. (London) A224, 134-40(1954) June 9.

The absorption spectrum of gaseous aluminum monofluoride has been examined in the region 1250 to 2000 A. Six new singlet band systems have been found. Four of the excited states have also been observed in emission in transitions to the lowest excited singlet state $A^1\Pi$, at longer wave lengths. The energies and products of dissociation of some of the states are considered. (auth)

GRAPHITE

5523

Minerals and Metals Advisory Board, National Research Council

NATURAL GRAPHITE. Paul M. Tyler. June 29, 1953. 50p. (MMAB-44-C)

General description of the graphite industry, grades and specifications, graphite refractories, use of domestic graphite for crucibles, other uses of domestic flake, methods of beneficiation, and possible research problems are discussed. (L.T.W.)

5524

THE TECHNOLOGY AND FABRICATION OF GRAPHITE. L. D. Loch and J. A. Slyh (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 39-44(1954)

Graphite products have been used widely in nuclear development and production, chiefly as reactor moderators and reflectors and as crucible materials for special metals and alloys. Also, considerable progress has been made in developing graphite for fuel-element matrices for high-temperature power reactors. Graphite products with a wide range of physical properties are produced commercially from selected combinations of many different raw materials. Most frequently, however, a petroleum-coke filler is used with a coal-tar pitch binder. The two materials are mixed and formed into shape at temperatures high enough to impart plasticity to the binder. Forming may be by extrusion or by molding. The products are gas baked and then graphitized at temperatures between 4500 and 5500°F. The properties of graphite which are of particular interest in reactor technology, low thermal neutron absorption cross section, high moderating ratio, high sublimation temperature, good thermal conductivity, excellent resistance to thermal shock, high strength, and resistance to creep at very high temperatures, are discussed. (auth)

5525

EXPERIENCE WITH GRAPHITE AS A FABRICATION MATERIAL IN HIGH-TEMPERATURE HEAT-TRANSFER SYSTEMS. R. D. Keen (North American Aviation, Inc., Downey, Calif.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 45-51(1954).

The tensile strength, density, liquid and gas permeability, oxidation, and solubility in and combination with metals of graphite are discussed. The fabrication of graphite and its use in a high-temperature heat-transfer system are described. Results obtained in a system using liquid Sn as the working fluid indicated that graphite had considerable durability and excellent heat-transfer properties in conjunction with a liquid-metal working fluid. At the end of a 500-hr operating period the graphite system was still free of leaks. Examination revealed no evidence of damage to the graphite by the action of the liquid metal. (J.A.G.)

LABORATORIES AND EQUIPMENT

5526

Duke Univ.

FUNDAMENTAL RESEARCH IN ORGANIC FLUORINE CHEMISTRY. STUDIES IN FLUORINATION REACTOR DESIGN. E. A. Tyczkowski. [1953] 53p. Contract DA-36-034-ORD-295. (NP-5262)

Various reactors designs for use in studies of the reaction of elementary fluorine with organic compounds are described. Quantitative observations on the types of flames observed and results under conditions aimed at both increasing and decreasing the vigor of the reaction are presented. (C.H.)

5527

FLUOROSCOPE AND GEIGER COUNTER FOR MEASURING ULTRAVIOLET ABSORPTION OF CHROMATOGRAMS. T. D. Price and P. B. Hudson (Columbia Univ. Coll. of Physicians and Surgeons, New York). Anal. Chem. 26, 1127-32(1954) July.

In search for new criteria for radiochemical purity of labeled nucleotides, it was necessary to determine accurately distribution of the compounds on paper chromatograms. Measurement of light absorption in the 240- to 290-mμ region of the far ultraviolet was an obvious approach, but the techniques of photoelectric densitometry could not be applied in this spectral region without improved means to confine sensitivity of a lamp-detector

combination to light of wave length absorbable by the compounds under investigation. Materials expected to have appropriate wave-length-dependent sensitivity to ultraviolet radiation were tested as detectors. The halophosphate fluoroscope and the stainless steel cathode Geiger tube were found sensitive to radiation in the far ultraviolet and unresponsive to the light of longer wave length emitted by all ultraviolet lamps. Employed as described, they are effective detectors of two new categories of simple and precise densitometric instruments. Sensitivity of the counting photometer would appear to meet any requirement of chromatographic densitometry, and that of the fluoroscopic photometer can be increased enormously by modifications indicated. The instruments are easily applied for measuring absorption of chromatograms because of insensitivity to room illumination. The prevalence of ultraviolet absorption among compounds separated by paper chromatography and performance characteristics of the instruments suggest analytical applications of wider scope. (auth)

5528

A STATISTICAL STUDY OF THE PERFORMANCE OF AN AINSWORTH MICROCHEMICAL BALANCE. EFFECTS OF AMBIENT CONDITIONS. James T. Waber and Gladys E. Sturdy (Los Alamos Scientific Lab., N. M.). Anal. Chem. 26, 1177-80(1954) July. (cf. NSA 6-4122).

The performance of an Ainsworth microchemical balance has been studied, and the results have been analyzed statistically. Samples of platinum, gold, and aluminum were repeatedly weighed against gold weights, and, simultaneously, the humidity and the temperature in the room and within the balance case were measured. Correlations between the specimen weight and temperature and humidity were investigated. No significant correlation between the variations in weight of specimen and the variations in either the balance humidity, the room humidity, or the difference between these humidities was observed. Significant correlations were obtained between the weights and the elapsed time. Significant correlations with temperature were not observed. The apparent weight of the aluminum specimen increased with increasing temperature, and the effect of temperature on the buoyancy of the specimen is adequate to account for the observed trend. Any effect resulting from static electricity was not investigated. The uncorrelated variations in weight were 2.0, 2.5, and 2.6 μg. The values approach the practical lower limit of microchemical balance design. A small effect of temperature on the standard deviation of weighing was possibly detected, but the difference between two temperature ranges was not statistically significant. (auth)

5529

AN AUTOMATIC SYSTEM FOR THE STUDY OF CATALYTIC REACTIONS INVOLVING GASES. K. W. Hannah, M. J. Joncich, and Norman Hackerman (Univ. of Texas, Austin). Rev. Sci. Instr. 25, 636-9(1954) July.

An automatic system, employing a metal bellows, was designed and constructed for the purpose of studying the catalytic combination of hydrogen and oxygen on a submerged catalyst in a stirred solution. The reaction was carried out under conditions of constant temperature, pressure, and volume. This system can be used to study the reaction for unlimited lengths of time; it is completely automatic and can be used to study reaction rates quantitatively. It can be modified for the study of other reactions. (auth)

RADIATION CHEMISTRY

5530

Aircraft Propulsion Lab., Univ. of Mich.

EFFECT OF ATOMIC RADIATION ON THE COMBUSTION OF HYDROCARBON AIR MIXTURES. Robert E. Cullen and Martin E. Gluckstein. [June 1954]. 14p. Contract [AT(11-1)-162]. (AECU-2922)

The effect of nuclear radiation on combustion of hydrocarbon–air flames has been experimentally investigated from a phenomenological standpoint. No attempt was made to obtain kinetic data, but it is shown that the results obtained are consistent with proposed mechanisms for flame propagation and the interaction of radiation and matter. It was demonstrated that the combustion effectiveness is increased by a strong source of radiation in the vicinity of the radiation zone. (auth)

5531

GAMMA-RAY-INITIATED POLYMERIZATION OF STYRENE AND METHYL METHACRYLATE. D. S. Ballantine, P. Colombo, A. Glines, and B. Manowitz (Brookhaven National Lab., Upton, N. Y.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 267-70(1954).

The γ-ray-induced polymerization of styrene and methyl methacrylate was investigated and was shown to be free radical in nature. Both monomers show a constant rate of polymerization in the initial stages followed by a rapid increase similar to a "Trommsdorf" effect. Molecular-weight increase occurs with the increased rate. There is some indication of cross linking of polymer. Activation energies for combined propagation and termination rates were calculated and agree well with published values for free-radical polymerization involving bimolecular termination. (auth)

5532

GASES LIBERATED DURING THE HIGH VOLTAGE ELECTRON IRRADIATION OF POLYETHYLENE. Elliott J. Lawton, P. D. Zemany, and J. S. Balwit (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Am. Chem. Soc. 76, 3437-9(1954) July 5.

The gases liberated by electron bombardment of polyethylene were determined. H_2 accounted for approximately 85% of the total volume liberated, and the remaining gas consisted predominantly of hydrocarbons containing 2, 3, and 4 C atoms. The pressure of the gases was found to increase linearly with the radiation up to a total dose of 16×10^6 r. From the H_2 data, the efficiency of cross-linking was calculated to be 1.87. (J.S.R.)

5533

CHEMICAL ACTION OF IONIZING RADIATIONS: EXCITATION OF OPTICAL LEVELS BY PARTICLES OF RELATIVELY LOW ENERGY. Joseph Weiss (Univ. of Durham, Newcastle upon Tyne, England). Nature 174, 78-9(1954) July 10.

A brief theoretical treatment is presented of the excitation of optical levels in solutions by low-energy particles. (L.T.W.)

5534

MOLECULAR-WEIGHT CHANGES IN THE DEGRADATION OF LONG-CHAIN POLYMERS. A. Charlesby (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A224, 120-8(1954) June 9.

The changes in molecular weight of a long-chain polymer (initially of arbitrary molecular-weight distribution) are studied when the main chain is subjected to random fracture, such as occurs when certain polymers are exposed to high-energy radiation. For several distributions studied, all trace of the initial distribution curve is lost after an average of some 3 to 8 main-chain fractures per molecule. For lower degrees of degradation the shape of the curve of weight average against degradation can provide information as to the initial weight average, z average, z + 1 average molecular weights. The initial number average can be obtained by a method of extrapolation. (auth)

RADIATION EFFECTS

5535

THE LINE SHAPE OF MONOCHROMATIC γ-RADIATION IN SCINTILLATION SPECTROMETERS. D. Maeder, R. Müller, and V. Wintersteiger. Translated from Helv. Phys. Acta 25, 465-7(1952). 36p. Available from Technical Services, (Trans-52F3G), East Orange, N. J. (AEC-tr-1941)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-265. (C.H.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5536

TERBIUM TETRAFLUORIDE: PREPARATION AND PROPERTIES. B. B. Cunningham, D. C. Feay, and M. A. Rollier (Univ. of California, Berkeley). J. Am. Chem. Soc. 76, 3361-3(1954) July 5.

Solid terbium tetrafluoride has been prepared by the reaction: $TbF_{3(c)} + \frac{1}{2}F_{2(g)} \xrightarrow{320°} TbF_{4(c)}$. The crystalline tetrafluoride is monoclinic and isostructural with the tetrafluorides of cerium, uranium and thorium. The compound is inert to cold water but reacts fairly rapidly with acidified solutions of aluminum nitrate. No $PrF_{4(c)}$ was formed under conditions suitable to the formation of $TbF_{4(c)}$ and $CeF_{4(c)}$. (auth)

SEPARATION PROCEDURES

5537

Los Alamos Scientific Lab.

SEPARATION OF AMERICIUM FROM LANTHANUM BY FRACTIONAL OXALATE PRECIPITATION FROM HOMOGENEOUS SOLUTION. J. A. Hermann. Oct. 1953. Decl. with deletions July 22, 1954. 22p. Contract W-7405-eng-36. (AECD-3637; LAMS-1625)

A separation of americium from americium-lanthanum mixtures is obtained by the fractional precipitation of dilanthanum trioxalate from homogeneous solution. The precipitating agent is generated through the slow hydrolysis of dimethyl oxalate. Americium is enriched in the precipitate and is coprecipitated according to the logarithmic distribution law, $\log [(Am)_i/(Am)_f] = \lambda \log [(La)_i/(La)_f]$, over a composition range of at least 0.01 to 20 mole per cent Am in the precipitate. The subscript i refers to the initial concentration of the element in solution, the subscript f to the final concentration in solution after precipitation, and λ is a constant characteristic of the system which approaches a limiting value of approximately 6 as the rate of precipitation becomes slow. Americium was separated from all other cationic impurities detected to a degree equal to or greater than the separation from lanthanum. The impurities detected included bismuth, iron, chromium, aluminum, lead, manganese, magnesium, calcium, strontium, and barium. (auth)

5538

ION EXCHANGE AS A SEPARATION METHOD. VII. RELATIVE ELUTION POSITIONS OF LANTHANIDE AND ACTINIDE ELEMENTS WITH LACTIC ACID ELUANT AT 87°. Leon Wish, Edward C. Freiling, and Leland R. Bunney (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). J. Am. Chem. Soc. 76, 3444-5(1954) July 5.

A number of column studies were made of the elution of Ho, Dy, Tb, Cf, Gd, Eu, Sm, Cm, Am, Pm, and element 99 from Dowex-50 with pH3 lactate solutions at 87°C. The results are tabulated. For lactic acid the relative elution positions of lanthanide and actinide homologs are related by a logarithmic equation. (J.S.R.)

SPECTROSCOPY

5539

Ames Lab.

INFRARED FUNCTIONAL GROUP ANALYSIS OF ARYL SILANES. M. Margoshes and V. A. Fassel. July 8, 1954. 14p. Contract W-7405-eng-82. (ISC-501)

An infrared spectrometric method is described for the determination of the concentration ratio of phenyl and p-tolyl groups in tetra-arylsilanes and hexa-aryldisilanes. Accurate results are possible even though the molar absorptivities of the functional groups are not constant. Determination of group concentration ratios, rather than individual concentrations, permits use of unweighed samples. (auth)

SYNTHESES

5540

Atomic Energy Project, Univ. of Rochester

ORGANIC SYNTHESIS OF CARBON-14 LABELED HEMATOPORPHYRIN DIMETHYL ESTER. Alan K. Bruce. June 17, 1954. 51p. Contract W-7401-eng-49. (UR-339)

Procedures are presented for the synthesis of hematoporphyrin dimethyl ester with C^{14} labeling in the asymmetric carbon atoms and with a specific activity 5250 cpm/mg. Criteria of purity and means of identification applied to the compounds involved in the synthesis are discussed. (C.H.)

TRACER APPLICATIONS

5541

University of Southern Calif.

EXCHANGE STUDIES WITH COMPLEX IONS. EXCHANGE AND AQUATION STUDIES WITH THIOCYANATE COMPLEXES. Arthur W. Adamson and R. G. Wilkins. Nov. 1953. 30p. Contract N6onr-23809. (AD-24369)

The first order aquation rate constants for the replacement of thiocyanate by water have been determined for the complex ions $Cr(NH_3)_5(SCN)^{++}$, $Co(NH_3)_5(SCN)^{++}$, and trans $Co\ en_2(SCN)_2^+$. For the first two, the respective values in min^{-1} are $k = 1.17 \times 10^{13}$ exp.(–24,900/RT) and $k = 0.85 \times 10^{13}$ exp.(–26,800/RT), with $\Delta S^+ = -7.8, -8.4$ E.U. The rate of bimolecular exchange of thiocyanate ion with the $SC^{14}N$ labeled complexes was found to be not more than a few percent of the aquation rates, being undetectable against the aquation background. The aquation of $Co(NH_3)_5(SCN)^{++}$ was found to be catalyzed by thiocyanate ion while for $Cr(NH_3)_5(SCN)^{++}$ no such enhancement of rate was found. An interpretation of this and other aspects of ligand replacement with trivalent chromium and cobalt complexes is presented whereby it is inferred that an S_N2 mechanism holds for chromium complexes and an S_N1 mechanism for those of cobalt. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

5542

Radiation Lab., Univ. of Calif., Berkeley

STUDIES IN THE NUCLEAR CHEMISTRY OF PLUTONIUM, AMERICIUM, AND CURIUM AND THE MASSES OF THE HEAVIEST ELEMENTS (thesis). Richard Alois Glass. Apr. 20, 1954. 202p. Contract W-7405-eng-48. (UCRL-2560)

Ion exchange column elution methods for the separation of americium and curium using tartrate and lactate solutions have been developed which are superior to citrate elutions. Tartrate elutions are suitable for slow separations and lactate elutions are satisfactory for general use where rapid separations are required. Fission and spallation products were isolated from Pu^{239} targets which had been bombarded with alpha particles of 21- to 37-Mev energy. Fission yield curves as well as fission and spallation excitation functions are presented and discussed in terms of odd-even and Z^2/A effects. The high cross sections observed for the $(\alpha,2n)$ and $(\alpha,p2n)$ reactions were surprising results from this investigation. In the course of the Pu^{239} bombardments, studies of the decay schemes of Am^{240}, Cm^{240}, and Cm^{241} were undertaken. Decay energy and half-life information

on all of the trans-mercury nuclides has been collected and systematized. Trends on the energy surface for alpha energies, beta energies, nucleon binding energies, and Bohr-Wheeler parameters are presented. These energy systematics have led to a complete tabulation of the masses of the isotopes of the elements above mercury. Predictions of nuclear properties are included for some isotopes of elements 99 through 103. (auth)

5543

Radiation Lab., Univ. of Calif., Berkeley

CHEMICAL PROPERTIES OF ELEMENTS 99 AND 100. S. G. Thompson, B. G. Harvey, G. R. Choppin, and G. T. Seaborg. July 23, 1954. 36p. Contract 7405-eng-48. (UCRL-2591(rev.))

A description of some of the chemical properties and of the methods used in the separations of elements 99 and 100 is given. The new elements exhibit the properties expected for the tenth and eleventh actinide elements. Attempts to produce an oxidation state greater than III of element 99 have been unsuccessful. In normal aqueous media only the III state of element 100 appears to exist. The relative spacings of the elution peaks of the new elements in some separations with ion exchange resin columns are the same as the relative spacings of the homologous lanthanide elements. The results of experiments involving cation exchange resins with very concentrated hydrochloric acid eluant show that the new elements, like the earlier actinides, are more strongly complexed than the lanthanides. The new elements also exist partially as anions in concentrated hydrochloric acid, as do earlier actinide elements, and they may be partially separated from each other by means of ion exchange resins. With some eluants interesting reversals of elution positions are observed in the region Bk-Cf-99-100, indicating complex ion formation involving unusual factors. (auth)

URANIUM AND URANIUM COMPOUNDS

5544

Raw Materials Development Lab., American Cyanamid Co., Atomic Energy Div.

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH THIOCYANATE. Michael A. DeSesa and Oscar A. Nietzel. July 19, 1954. 19p. Contract AT(49-1)-533. (ACCO-54)

The spectrophotometric determination of uranium as the thiocyanate complex in a mixed water–acetone medium was found very satisfactory for analysis of the high-grade uranium samples of synthetic composition. Ore samples and leach liquors could not be analyzed by this method without a preliminary separation of interfering cations, especially iron and vanadium. Therefore, a new method was developed which consists of a preliminary ethyl acetate extraction of the uranium followed by development of the color on a portion of the extract. The separation was found to be quantitative in one extraction under the proper conditions and efficient for all known interferences except titanium. Solutions containing up to 5 grams Ti/L could be analyzed by first precipitating the titanium in the extraction vial with p-hydroxyphenylarsonic acid. The new method was found to be rapid, reproducible, and accurate for samples containing at least 0.05 g U_3O_8/L. (auth)

5545

Los Alamos Scientific Lab.

ORIENTED DIOXIDE FILMS ON URANIUM. J. T. Waber and J. A. O'Rourke. July 6, 1954. Decl. July 22, 1954. 15p. Contract [W-7405-Eng-36]. (AECD-3636)

The formation of oriented layers of UO_2 on U was studied in the temperature range 300 to 1000°C and at water pressures below 25 mm Hg. High degrees of orientation are formed only when the pressure exceeds about 0.8 mm Hg. The (110) planes are formed parallel to the metal surface. In vacua the principal orientation of the dioxide is with the (100) planes parallel to the surface, but by further oxidizing the sample in water vapor, the (110) orientation is developed. A preliminary investigation of the rate law indicates that a logarithmic law is obeyed. (J.S.R.)

5546

URANIUM AND FABRICATION. J. Van Impe. Chem. Eng. Progr. 50, 230-4(1954) May.

Methods of U preparation and fabrication developed and used by the Belgium atomic energy project are reviewed. The method of preparation includes conversion of $UO_4 \cdot 2H_2O$ to UO_3, reduction of UO_3 to UO_2, fluorination of UO_2, decomposition of $NH_4 \cdot UF_5$ to UF_4, and reduction of UF_4 with Ca. 19 references. (L.T.W.)

5547

METALLURGY OF URANIUM. H. A. Saller and F. A. Rough (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr Symposium Ser. No. 11, 63-7(1954).

The development of uranium metallurgy has been handicapped by some of its peculiar properties. It is extremely active chemically, reacting readily with the atmosphere and most crucible materials. Since uranium is anisotropic, its mechanical properties are dependent on orientation and are greatly affected by variations in fabricating techniques. Although a number of techniques for reducing uranium compounds to metal are feasible, recent efforts have been concentrated on the reduction with calcium or magnesium and the electrolysis of uranium halides. Methods for melting, casting, and fabricating uranium have developed any number of fabricated shapes. Uranium machines reasonably well and can be welded and brazed. Protective coatings may be put on by electroplating, roll-cladding, or jacketing. Uranium alloys are a means of increasing strength, improving corrosion resistance, lowering the melting point, or diluting enriched uranium for power reactors. A number of alloy systems have been studied extensively, and a large number of constitutional diagrams are available. Constitutional diagrams of Al-U, Cr-U, Ta-U, Th-U, and U-Zr alloys are included. (auth)

5548

THE EXTRACTIVE METALLURGY OF URANIUM. R. D. MacDonald (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 69-74(1954).

For the purposes of extractive metallurgy, uranium ores may be grouped into five types according to the minerals present. Treatment of an ore depends to a major extent on its type considering both the ore minerals and the gangue minerals. Some ores are amenable to physical concentration methods, but most ores require either acid or alkaline leaching, which for some minerals must be rigorous. Successful leaching with either acid or carbonate depends on oxidizing the poorly soluble uranous uranium to the highly soluble uranyl form. Methods for the recovery of uranium from both acid and alkaline solutions are discussed. (auth)

WASTE DISPOSAL

5549

Mine Safety Appliances Co.

UNDERWATER DISPOSAL OF MOLTEN SODIUM. R. C. Andrews and E. C. King. July 30, 1954. 18p. Contract NObs-65426, Technical Report No. 29. (NP-5261)

Sodium at 350°F was discharged under 10 ft of water through an open end annulus (free area of 0.226 sq in.) at

flow rates of approximately 90 lbs/min. The reactions resulted in little sodium oxide smoke and no hydrogen fires, showing that large quantities of sodium can be disposed of under water with little surface reaction, provided a minimum depth of 10 ft is maintained. (auth)

5550

RADIOACTIVE WASTES. TREATMENT, USE, AND DISPOSAL. W. A. Rodger (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 50, 263-6(1954) May.

Radiation characteristics of wastes, accumulation of fission products in wastes, waste volume accumulation, bulk reduction of wastes, cost of bulk reduction and storage, fission product utilization, and final storage of wastes are reviewed. 13 references. (L.T.W.)

ENGINEERING

5551

SEALING OF METALS AND CERAMICS. M. Kuhner. Translated by Yvette De Felice from Vide, Le 2, 194-204 (1947). 18p. (AEC-tr-1945)

Methods are described for sealing ceramic materials to metals in electronic vacuum tubes. (C.H.)

5552

NUCLEAR ENGINEERING. A CHEMICAL ENGINEERING REVIEW. Chem. Eng. Progr. 50, 217-20(1954) May.

A brief review of technical and economic factors which affect chemical engineers in nuclear engineering is presented. Nuclear power, the world food supply factor, present nuclear fuel sources, nuclear fuels, fuel production, how fuels burn, the nuclear reactor and the problems of removing its heat, fuel contamination, chemical separation plants, waste disposal, and the chemical engineering future are very briefly discussed. (J.A.G.)

HEAT TRANSFER AND FLUID FLOW

5553

Radiation Lab., Univ. of Calif., Berkeley

FILM BOILING OF FLOWING SUBCOOLED LIQUIDS (thesis). Eugene Izoard Motte. June 1954. 139p. Contract W-7405-eng-48. (UCRL-2511)

Heat transfer coefficients across the vapor film were evaluated from the rates of heat transfer in upward-flow forced convection from outside single horizontal tubes to four liquid systems: ethyl alcohol, benzene, hexane and carbon tetrachloride. These heat transfer coefficients were found to be markedly increased by subcooling the liquids. It has previously been shown that, since the vapor film is in laminar flow in forced convection film boiling, heat is transferred across the vapor film by conduction and radiation. In this study it has been further shown that, if the liquid is subcooled, heat is transferred from the vapor liquid interface into the liquid by eddy conduction and the effect of thermal conduction is negligible. (auth)

5554

HEAT TRANSFER TO SUPERCRITICAL WATER AND OTHER FLUIDS WITH TEMPERATURE-DEPENDENT PROPERTIES. Kurt Goldmann (Nuclear Development Associates, Inc., White Plains, N. Y.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 105-13(1954).

A new method of analysis is proposed which may be used to predict heat-transfer and pressure-drop characteristics for fluids with temperature-dependent properties in fully developed turbulent flow. The new method is a further extension of the Reynolds analogy and its later modifications between turbulent momentum exchange and heat transfer. In applying the Reynolds analogy, the turbulent momentum exchange is sufficiently described by a universal velocity profile, $u^+ = \phi\ (y^+)$, which has been well established experimentally for fluids with constant thermodynamic and transport properties. The proposed method is based on an assumption which allows an adaptation of the universal velocity profile to fluid flow with variable properties. Results obtained with the proposed method are shown to be in good agreement with experimental data obtained for air under high heat fluxes. The proposed method has also been used to predict heat-transfer and pressure-drop characteristics for water at 5000 psi. flowing turbulently through round tubes. The results are given in graphical form relating useful heat-transfer and shear-stress parameters to bulk and wall temperatures. (auth)

5555

PRESSURE DROP AND HEAT TRANSFER TO NONBOILING AND BOILING WATER IN TURBULENT FLOW IN AN INTERNALLY HEATED ANNULUS. R. P. Stein, J. W. Hoopes, Jr., M. Markels, Jr., W. A. Selke, A. Bendler, and C. F. Bonilla (Columbia Univ, New York). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 115-26(1954).

Water was pumped through annuli $\frac{1}{8}$ in. wide, 1.08 in. I.D., and 14 ft long, electrically heated at their inner surfaces. Uniform and cosine heat-flux distributions were employed, as well as concentric and 30% eccentric annuli. Nonboiling over-all friction factors for concentric annuli agreed with pipe values and for the eccentric case were about 30% less. Circumferential average local heat-transfer coefficients agreed with the Colburn j-factor correlation for turbulent flow inside tubes and were substantially independent of eccentricity. The usual definition of film temperature correlated the results best. Efflux velocities with boiling were well above the calculated maximum values for homogeneous fluids. Inlet pressures during coolant boiling were checked by two incremental calculation methods. Homogeneous, or fog, flow gave inlet pressures that were somewhat too high, and Martinelli and Nelson's slip flow gave pressures too low by a larger amount. A modified plot by Lockhart and Martinelli of ϕL was obtained which gives good agreement in calculating two-phase frictional pressure drop for the runs reported. It is recommended for downward flow in concentric annuli of similar dimensions. (auth)

5556

USE OF THE CYCLIC HEAT-TEMPERATURE VARIATION METHOD FOR MEASUREMENT OF REACTOR HEAT-TRANSFER COEFFICIENTS. S. L. Fawcett and R. E. Grimble (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 135-7(1954).

A cyclic heat-transfer method which requires only the measurement of the fluid at the inlet and the exit of the test specimen and does not require a detailed knowledge of the test-specimen geometry in solving the heat-balance equations is proposed. Measurement of the average heat-transfer coefficients of reactor-core configurations and the amount of corrosion or scale buildup on fuel-element surfaces and the effect on heat transfer is discussed. (J.A.G.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

5557

Ames Lab.

PREPARATION AND PROPERTIES OF CALCIUM ZIR-

CONATE. M. R. Nadler and E. S. Fitzsimmons. June 24, 1954. 19p. Contract W-7405-eng-82. (ISC-494)

Preparation of calcium zirconate by solid-state reactions at 1450 to 2000°C is described. A very stable material can be prepared by the reaction of calcium carbonate and zirconium oxide, in equimolar proportions, at a final temperature of 1850°C. Lattice constant values for this material agree with data reported by previous investigators. Results of firing behavior tests indicate that pure $CaZrO_3$ can be used at temperatures of 1800°C or higher. The linear coefficient of thermal expansion over the temperature range 25 to 1300°C is 11.5×10^{-6} per °C. (auth)

CORROSION

5558

Naval Engineering Experiment Station, Annapolis
CORROSION OF MATERIALS IN HIGH TEMPERATURE WATERS. C. J. Lancaster and W. L. Williams. Feb. 9, 1954. 26p. (EES-040028F)

Results are reported on a number of laboratory experiments dealing with the problem of stress-corrosion cracking of austenitic stainless steels in boiler water environments. The data support an earlier conclusion that Navy boiler water treatment inhibits the cracking in materials submerged in the water. However, the treatment is not effective with materials above the liquid level. Cracking could be produced easily in the vapor phase at water temperatures, water compositions, and material stress levels of practical interest. In addition, it was demonstrated that this type of cracking could occur in practical applications. The demonstration consisted of an inspection and location of numerous cracks in a stainless steel cyclotherm boiler used for hotel services aboard AM 421 class nonmagnetic mine sweepers. (auth)

5559

Naval Engineering Experiment Station, Annapolis
EFFECT OF CARBON CONTENT ON MARINE CORROSION RESISTANCE OF CAST 19-9 Cr-Ni STEEL. W. Lee Williams. Sept. 28, 1953. 13p. (EES-040039A)

Seven cast 19 Cr–9 Ni austenitic steels, with carbon contents ranging from 0.06 to 0.45%, and each containing an austenitic steel weld deposit, were exposed in marine environments. The specimens were exposed without benefit of post-welding solution heat treatment. The purpose was to determine if, and to what extent, intergranular corrosion would occur. Although the steels containing carbon from about 0.15% and above were sensitive to intergranular attack in Strauss solution, no evidences of intergranular corrosion were observed after five months in sea water. Local pitting and crevice attack was a much more important factor in this environment. (auth)

5560

MICROSTRUCTURE AND THE CORRODIBILITY OF STEEL IN INHIBITED HYDROCHLORIC ACID SOLUTIONS. P. H. Cardwell (Dowell Inc., Tulsa, Okla.). J. Electrochem. Soc. 101, 84-90(1954) Feb.

In a study of the corrodibility of steels it was found that the degree of annealing as measured by the resolution of the pearlite, the grain size, and the presence of the Widmanstatten structure has considerable influence on the corrosion rate of the steels. Two acid inhibitors were examined in order to investigate materials which could be used satisfactorily to protect different grain structure steels during industrial applications of inhibited hydrochloric acid solutions. (auth)

5561

POTENTIALS OF IRON, 18-8, AND TITANIUM IN PASSIVATING SOLUTIONS. Herbert H. Uhlig and Arthur Geary (Massachusetts Inst. of Tech., Cambridge). J. Electrochem. Soc. 101, 215-24(1954) May.

Potentials of iron in chromates show a linear relation for $C/\Delta E$ vs. C, where C is concentration and ΔE is change of potential, suggesting that they follow the Langmuir adsorption isotherm. Maximum potential change corresponding to an adsorbed monolayer of chromate ions occurs at 0.0025 molar K_2CrO_4, which approximates the minimum concentration for passivity reported by Robertson. The evidence agrees with a primary mechanism of passivity based on absorption rather than on oxide film formation. For example, potentials of iron exposed to several organic inhibitors, where the mechanism is undoubtedly one of adsorption, also follow the adsorption isotherm as shown by Hackerman and coworkers. Passivity of 18-8 stainless steel and titanium in sulfuric acid containing cupric or ferric salts appears similarly to be accompanied by adsorption of Cu^{++} or Fe^{+++}. The irreversible nature of the potentials is in accord with the view that the adsorbate, in part, is chemisorbed. Hydroxyl ions in 4% NaCl produce more active potentials in passive 18-8 or titanium presumably by displacing adsorbed oxygen. Potentials of 18-8 in alkaline NaCl as a function of partial pressure of oxygen follow the adsorption isotherm, which adds confirming evidence that an adsorbed oxygen film is responsible for passivity. The decreased potentials between active and passive areas plus precipitation of passivity-destroying metal chlorides as hydrous oxides at incipient anodes accounts for inhibition of pitting in chloride solutions by alkalies. Calculated Langmuir isotherm constants, taking into account competitive chemisorption processes, agree qualitatively with expected relative values based on chemical properties of metals and adsorbates. (auth)

5562

KINETICS OF THE HIGH TEMPERATURE OXIDATION OF ZIRCONIUM. Jack Belle and M. W. Mallett (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 101, 339-42(1954) July.

The rate of oxidation of high-purity zirconium was determined for the temperature range of 575 to 950°C at 1 atm. pressure. Data can be fitted to a cubic law, and the rate constant in $(ml/cm^2)^3/sec$ has been calculated to be $k = 3.9 \times 10^6 \exp(-47{,}200/RT)$, where $47{,}200 \pm 1{,}000$ cal/mole is the activation energy for the reaction. (auth)

GEOLOGY AND MINERALOGY

5563

Department of Mines and Technical Surveys. Mines Branch (Canada)
RADIOACTIVITY DIVISION GENERAL PROGRESS REPORT [FOR] JANUARY–MARCH 1954. 42p. (GPR-1/54)

Investigations on uranium ores for private companies and individuals, a list of reports covering ore treatments, a numerical listing of chemical and radiometric assays of ores during the period, and associated activities are summarized. No technical data are included. (C.H.)

5564

Columbia Univ.
ANNUAL REPORT FOR JUNE 30, 1953 TO APRIL 1, 1954. PART 2. Paul F. Kerr, William J. Croft, Leo J. Miller, and T. Prescott Sciacca, Jr. May 1954. 98p. Contract AT(30-1)-702. (RME-3096(pt.2)).

X-ray-diffraction studies indicated that certain botryoidal pitchblendes have a fibrous texture. The diffuse diffraction maxima observed for uraninite crystals showed a disorder structure. A practical method is outlined for determining the true diffraction line breadth from a powdered sample using a geiger counter diffractometer. Some synthetic samples of UO_2 show varying crystallite dimensions depending upon temperature of crystallization. In natural pitchblendes

part of the line broadening is a disorder effect and occasionally part is due to small crystalline dimensions. In uraninite the disorder is due to a distribution of unit cells of varying sizes. A similarity exists between the texture of synthetic and natural pitchblende. The former consists of fibers which radiate from a common center and there is an indication that the crystallite size becomes larger at higher temperatures. Electron micrographs of synthetic pitchblende precipitates are given. (J.E.D.)

5565

PETROLEUM SULFONATE FLOTATION OF BERYL. S. M. Runke. U. S. Bur. Mines Rept. Invest. 5067, 19p. (1954) May.

Beryl was satisfactorily floated with numerous petroleum sulfonate reagents under varied conditions. Beryl-enriched products approximating marketable grades were recovered with these reagents from materials containing variable amounts of beryl. Treatment of a material containing 0.25% beryl yielded a product containing 66.5% beryl, with a recovery of 74.1% of the total beryl present. Treatment of a material containing 10.1% beryl produced a concentrate containing 97.4% beryl, with a recovery of 82.0% of the beryl present. (L.T.W.)

5566

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN EAST-CENTRAL ALASKA, 1949. Helmuth Wedow, Jr. M. G. White, and others. U. S. Geol. Survey Circ. 335, 1954. 22p.

Several mines and prospects in the Fairbanks and Livengood quadrangle were examined for radioactive deposits. The greatest radioactivity found was in an iron-stained pre-Cambrian schist and in a carbonaceous shale. Samples contained 0.003 and 0.004% equivalent U. No radioactive minerals warranting further study were located. Granite of the Mesozoic age in the Miller House–Circle Hot Springs area was found to contain 0.005 to 0.007% equivalent U. Additional reconnaissance in the area appears warranted. Minor amounts of radioactive materials were found associated with Cu ores at the Copper Creek prospect in the Eagle district where a small roof pendant in the "Charley River" batholith appears to be highly mineralized. Studies of 24 placer-concentrate samples from the Fortymile district revealed the radioactivity to be due to traces of uranium-bearing thorianite. No data are available as to the source of the thorianite. Chapter E of this circular appeared as TEI-196 and was abstracted in Nuclear Science Abstracts as NSA 8-1084. (J.E.D.)

5567

FLUORSPAR DEPOSITS OF UTAH. W. R. Thurston, M. H. Staatz, D. C. Cox, and others. U. S. Geol. Survey Bull. 1005, 1954. 53p.

The studies of fluorspar localities in Utah made by the U. S. Geological Survey during and since the recent war are summarized. The fluorspar at the Cougar Spar and Blue Bell mines in the Indian Peak Range of western Beaver County occurs as fissure veins in fault and breccia zones in volcanic and intrusive rocks. At the Monarch (Staats) claims in west-central Beaver County fluorspar was mined chiefly from a fault between limestone and rhyolite porphyry. The Thomas Range district in Juab County has yielded sizeable tonnages of fluorspar from pipes in faulted dolomite and rhyolite porphyry. From 1918 to 1924 the Silver Queen mine in Tooele County produced fluorspar from fissure veins in faulted limestone. The report describes the geology of producing mines and the various prospects examined. Production and reserves of fluorspar for Utah are summarized. (auth)

METALS AND METALLURGY

5568

Virginia Inst. for Scientific Research

THE ELECTRODEPOSITION OF TITANIUM FROM AQUEOUS SOLUTIONS. FINAL TECHNICAL REPORT. Thomas C. Franklin and Francis J. Denise. Aug. 31, 1953. 55p. Contract DA-36-034-ORD-1048. (AD-18240)

Preliminary experiments showed that Ti can be deposited electrolytically from aqueous colloidal solutions. The solutions were prepared by the Bredig arc method; the medium was water to which had been added a trace of NaOH and rosin or polyethylene glycol 600. X-ray analysis of the deposit indicated it to be Ti contaminated with oxides. The colloidal particles migrated to the anode and deposited there as a thick nonadherent coating. Polarographic investigations of the electrolytic reduction of Ti indicated that divalent Ti was produced only in a bath containing KCN as the only complexing agent. Polarographic investigations also showed that organic reagents will not raise the H overvoltage on Hg. The same reagents had no effect on the reduction wave of Ti. Attempts to electroplate Ti from aqueous solutions containing complexing agents such as citrate and tartrate ions were unsuccessful, except in 2 cases in which promising results were obtained. In the first case, a metallic deposit obtained in spots on a Pb cathode from a water solution of $TiCl_4$ gave a positive chemical test for Ti. In the second case, x-ray analysis of a deposit obtained on Hg cathode from a water solution of $TiCl_4$ containing acridine showed very weakly the 2 strong diffraction lines of Ti. Efforts to electrodeposit Ti on amalgams in which Ti might be expected to be soluble were unsuccessful. Efforts to codeposit Ti with other metals were also unsuccessful. (ASTIA abst.)

5569

Kentucky Research Foundation, Univ. of Ky.

SCALING OF TITANIUM AND TITANIUM ALLOYS. PROGRESS REPORT NO. 7 [FOR] JULY 1, 1953 TO OCTOBER 1, 1953. H. W. Maynor, Jr., C. J. Sparks, Jr., and B. R. Barrett. Oct. 5, 1953. 35p. Contract AF-18(600)-60. (AD-21500)

Scaling data of the weight-increase type were obtained for unalloyed Ti and Ti-base alloys at 1200, 1400, 1600, and 1800°F. The total inches penetrated by oxide were determined as a criterion of scaling propensity. Chemical analysis indicated that the scales on Ti–4% Al alloy were composed of several strata which varied in number and nature with temperature and time of exposure. The scaling resistance of Ti–Al alloys was attributed to the resistance to diffusion offered by the Al oxide of the scale. (ASTIA)

5570

Battelle Memorial Inst.

INVESTIGATION OF WROUGHT IRON–CHROMIUM–ALUMINUM ALLOYS FOR SERVICE AT 2200°F. H. A. Saller, J. T. Stacy, and N. S. Eddy. June 28, 1954. 46p. Contract W-7405-eng-92. (BMI-922)

The effects of a number of added elements on the workability, oxidation resistance, strength, dimensional stability, bend ductility, hardness, and microstructure of an iron–chromium–aluminum alloy were investigated. The elements added to the base composition singly, or in combination, were beryllium, cerium, copper, magnesium, manganese, molybdenum, niobium, palladium, silicon, silver, tantalum, titanium, tungsten, vanadium, yttrium, and zirconium. The addition of 10 wt. % tantalum to the iron–chromium–aluminum base approximately quadrupled the 100-hr rupture strength at 2200°F in air, without loss in resistance to oxidation. Additions of 5 wt. % niobium or 5 wt. % tantalum tripled the strength. Other elements, with the

exception of palladium, were either less effective strengtheners or caused a deterioration in the resistance to oxidation. The best of these alloys approached the strength of Type 310 stainless steel at 2200°F but were slightly inferior in strength to Inconel. They were more resistant to oxidation than Type 310 stainless steel and equal to or better than Inconel in this respect. In addition to excellent high-temperature oxidation resistance, the iron–chromium–aluminum alloys possess relatively low thermal neutron absorption cross sections. (auth)

5571

Ames Lab.

THE ZIRCONIUM–COLUMBIUM DIAGRAM. B. A. Rogers and D. F. Atkins. June 29, 1954. 39p. Contract W-7405-eng-82. (ISC-500)

A brief review of the limited information available from previous publications, a description of the apparatus and methods used in the new investigation, and a constitutional diagram of the Zr–Nb alloy system is presented. Complete mutual solid solubility exists for an interval below the solidus line which is a continuous curve with a flat minimum near 22% Nb and 1740°C. Upon cooling, the solid solution breaks up, except at the Nb–rich side, from two causes. Zirconium-rich alloys transform under the influence of the beta-alpha transformation in zirconium; alloys of intermediate composition decompose into two solid solutions below 1000°C. The combined effect is the formation of a eutectic at a temperature of 610°C and a composition of 17.5% Nb. The eutectoid horizontal extends from 6.5 to 87.0% Nb. Some age hardening effects were observed in the zirconium-rich alloys, but the positions of the solvus lines remain uncertain. (auth)

5572

Rensselaer Polytechnic Inst.

SOME PROPERTIES OF THE HEAT-AFFECTED ZONE IN ARC-WELDED TYPE 347 STAINLESS STEEL. E. F. Nippes and H. Wawrousek, Rensselaer Polytechnic Inst. and W. L. Fleischmann, Knolls Atomic Power Lab. Mar. 1, 1954. 67p. Contracts AT(30-3)-93 and W-31-109-eng-52. (KAPL-1105)

The properties of Type 347 stainless steel in regions adjacent to arc welds were investigated mainly for a study of the effect of these properties upon the behavior of weldments at elevated temperatures. Specific microstructures associated with definite regions of the weld heat-affected zone were produced synthetically on the RPI time-temperature controller. Samples with uniform microstructure were obtained in sufficient size that the usable test specimens could be prepared. These samples were then used to study some of the mechanical and metallurgical change brought on by welding and as a consequence of post weld heat-treatment. The room-temperature impact strength exhibited a slight decrease in the samples heated to the highest peak temperature (2500°F). The rupture test at 1100°F of specimens heated to 2400°F showed a significant decrease of ductility. To study the carbide precipitation occurring in the weld heat-affected zone upon exposure within the sensitization range, a series of as-welded specimens were given a 1200°F treatment. Those samples which were originally heated to above 2400°F before the sensitization treatment exhibited severe attack by boiling 65% nitric acid. Photomicrographs are presented showing the metallurgical changes in the weld heat-affected zone. (auth)

5573

Knolls Atomic Power Lab.

THE STRESS-RUPTURE STRENGTH OF TYPE 347 STAINLESS STEEL UNDER CYCLIC TEMPERATURE. E. E. Baldwin. June 1, 1954. 65p. Contract W-31-109-Eng-52. (KAPL-1147)

Stress-rupture tests of Type 347 stainless steel were conducted in liquid sodium under constant and cyclic temperature conditions. Constant temperature tests were conducted at temperatures between 1000 and 1200°F. Cyclic test temperatures ranged from 416 to 1294°F, and cycle times ranged from 6 to 12 hours. It was concluded that the deviation of the test results from the rupture life calculated by the method of Robinson and Miller was due to transient creep of the steel under cyclic temperature changes. (auth)

5574

Livermore Research Lab., Calif. Research and Development Co.

AGING EFFECTS IN COMMERCIALLY PURE BERYLLIUM. D. R. Mash. May 1954. 33p. Contract AT(11-1)-74. (LRL-140).

Mechanical properties of beryllium were measured after several heat treatments. A strong yield point was found with attendant enhanced mechanical properties under the conditions: (1) Hot-pressed plate: Full annealing in the range 700 to 900°C with furnace cooling at approximately 2°C/min.; (2) Hot-pressed, warm extruded rods: Full annealing in the range 700 to 900°C with slow air cooling at approximately 5 to 7°C/min. Furnace cooling of hot-pressed, warm extruded bars from the solution range showed no yield point and exhibited lower tensile properties than material treated by other means. Beryllium specimens responded to both quench-aging and strain-aging treatments. Based on these results several possible means of obtaining increased normal temperature mechanical properties and/or increased product uniformity are suggested. (auth)

5575

[Engineering Research Inst.], Univ. of Mich.

HIGH-RESOLUTION AUTORADIOGRAPHY. George C. Towe, Henry J. Gomberg, and J. W. Freeman. June 1, 1953. 141p. (NACA-TN-3209)

The adaptation of high-resolution wet-process autoradiographic methods to the study of metal structures was investigated. In order to evaluate this technique samples of C^{14}-carburized iron and steel, Ni^{65} electroplated samples, a powder product containing Ni^{63}, and a high-temperature-resistant alloy containing W^{185} were prepared. It was demonstrated that autoradiographs can be produced which will resolve radioactive areas separated by less than 10 μ. The autoradiograph can be seen simultaneously under the microscope. Recommended procedures for preparation of the autoradiograms and a general discussion of the requirements for high-resolution autoradiography are included. (C.H.)

5576

Naval Ordnance Lab.

THE DEVELOPMENT OF X-RAY STANDARDS FOR SHIELDED ARC WELDS IN ALUMINUM. J. J. Hirschfield, D. T. O'Connor, J. J. Pierce, and D. Polansky. Nov. 21, 1950. 66p. (NAVORD-1595)

A set of x-ray standards for shielded-arc welds in aluminum has been established on the basis of guided bend and tensile tests of 300 specimens. Agreement between the two types of tests was good. It was concluded that all grades of incomplete penetration, dross, and cracks should be considered rejectable, that scattered porosity and tungsten inclusion do not significantly reduce strength, and that the intermediate and more severe grades of linear porosity and gas holes should be considered rejectable. A book of film standards has been prepared incorporating a summary of the test data. Although the specimens were prepared by Heliarc welding of one quarter inch 3S aluminum plate over a grooved steel back-up bar, the standards are intended to apply to all similar types of shielded-arc welding in 2S and 3S aluminum plate and particularly to mine case welds. (auth)

5577

National Bureau of Standards

ELECTRODEPOSITION OF TITANIUM. [QUARTERLY PROGRESS REPORT FOR] JANUARY 1–MARCH 31, 1954. W. Reid, J. Bish, and A. Brenner. Apr. 1, 1954. 6p. (NBS-3197)

Progress is reported on an investigation of methods for the electrodeposition of Ti. An investigation of Zr–Al alloy baths composed of $Zr(BH_4)_4$ + $LiAlH_4$ and $Zr(BH_4)_4$ + $LiAlH_4$ + $AlCl_3$ was continued. The preparation of $Zr(AlH_4)_4$ and $Zr(BH_4)_4$ is described. An investigation of organo–$TiCl_4$ for the electrodeposition of Ti, involving the reduction of $TiCl_4$ by reaction with LiH in ethers, is discussed. Results of Ti deposits produced by the electrolysis of benzyl sodium + Ti tetraisopropylate in tetrahydrofuran and Na_2TiCl_4 in $AlCl_3$–ethyl pyridinium chloride are given. (J.A.G.)

5578

Metals Research Lab., Case Inst. of Tech.

AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. TECHNICAL REPORT NO. 29. OVERCOMING RHEOTROPIC EMBRITTLEMENT BY TORSIONAL PRESTRAIN. I. Rozalsky. 76p. June 1954. Contract N-6-ONR-273/I. (NP-5249)

A correlation was made of the effects of tensile and torsional prestrain upon the tensile fracture properties of annealed copper, spheroidized SAE 1020 steel, and quenched and tempered SAE 1340 steel at various test temperatures. Evidence of rheotropic behavior was found at subtransition test temperatures for each of the two steels for both tensile and torsional prestrain. The helical "wolf-ear" tensile fracture obtained subsequent to critical magnitudes of torsional prestrain generally varied in appearance with decreasing supertransition test temperatures and essentially disappeared at subtransition test temperatures. (auth)

5579

Smith, A. O., Corp.

RESEARCH AND DEVELOPMENT FOR THE WELDING OF TITANIUM AND TITANIUM ALLOYS. FINAL REPORT [COVERING THE PERIOD DECEMBER 10, 1951 TO JANUARY 31, 1953]. THE WELDING OF TITANIUM AND TITANIUM ALLOYS. J. J. Chyle and Ivan Kutuchief. Apr. 30, 1954. 77p. Contract DA-11-022-ORD-137, Final Technical Report. (NP-5267)

Welding tests were conducted on 5 types of ½- to ⅝-in. thick plate of Ti alloys containing Cr, Fe, Mn, Al and Mo, using filler metal of strips removed from the parent plate material or wire of the same nominal composition as that of the parent alloy. The welding was performed with the inert-gas-shielded W-arc process, using He as a shielding gas and a thoriated grade of W electrodes in the welding torch. Radiographic tests and mechanical properties, as determined by tensile tests, indicated that successful welds with regard to soundness of Ti–Cr, Ti–Fe, Ti–Mn, and Ti–Cr–Mo alloys were made. The effects of post heat treatment on the mechanical properties of the welds were also determined. Post-welding heat treatment was necessary to eliminate cracking of Ti–Mn–Al alloys. Results of tensile, bend, and Charpy tests are given. The hardness of the deposited weld metal, parent stock, and heat-affected zones are given. Chemical analyses of the parent stock weld metal and of the filler metals were made. A study of the microstructure of the weld, heat-affected zone, and parent stock is presented. Flame-cutting tests on 150A, RS-120, and XCM alloys using the oxyacetylene process were carried out and machinability tests on the flame-cut edges were made. The tensile properties, bend ductility, and notch Charpy impact properties of welded flame-cut edges of the XCM alloy and the effect of peening on the weld hardness and ductility are reported. (J.A.G.)

5580

Horizons, Inc.

RESEARCH IN ELECTRICAL PROPERTIES OF INTER-METALLIC COMPOUNDS. FINAL REPORT [FOR] MAY 1, 1953 TO JUNE 30, 1954. Tien-Shih Liu and Renato Bobone. July 22, 1954. 46p. Contract AF 18(600)-774. (NP-5268)

Preparation and electrical measurements of Ni–Al alloys and Ni–Al–Cu ternary alloys in the cubic β region are reported. The measurements show that the locus of minima of the resistivity for the Ni–Al–Cu ternaries is to be found within a strip containing the transition line from nondefect to defect structures. Some measurements of resistivity and thermoelectric power vs. temperature are given. A qualitative explanation of the main features in the electrical behavior of the alloys, based on the Brillouin zone theory, is presented. (auth)

5581

Radiation Lab., Univ. of Calif., Berkeley

SPARK DAMAGE AND HIGH VOLTAGE BREAKDOWN OF METALS IN VACUUM AT 14 MEGACYCLES. (PRELIMINARY REPORT). Warren W. Chupp and Harry G. Heard. Jan. 1954. 74p. Contract W-7405-eng-48. (UCRL-1962(rev.))

This preliminary report compares the spark damage and breakdown voltage of Inconel, E.T.P. copper, D.H.P. copper, tantalum, molybdenum, nickel, C-18 carbon, K-Monel, stainless steel and satin chrome-plated copper. The tests were made in an oil pumped r-f cavity. Breakdown voltages are quoted for tests made with a 15,000 gauss magnetic field in a cylinder opposite parallel-plane geometry. The peak energy storage of the 14 megacycle cavity is approximately 10 joules. A discussion of pertinent observations is included. (auth)

5582

Materials Lab., Wright Air Development Center

WADC MAGNESIUM SYMPOSIUM HELD ON FEBRUARY 24, 1953. Henry A. Johnson, ed. Mar. 1953. 72p. (WADC-TR-53-405)

5583

Bureau of Mines, College Park, Md.

EFFECT OF ATMOSPHERIC CONTAMINANTS ON ARC WELDS IN TITANIUM. INTERIM TECHNICAL REPORT [FOR] JULY 1 TO DECEMBER 31, 1953. J. C. Barrett and I. R. Lane, Jr. 25p. (WAL-401/155-13)

Arc welds in ⅛, ¼, ½, and ⅞ in. thick titanium and melted titanium buttons were prepared under various controlled atmospheres. Tensile, bend, hardness, and impact properties together with changes in chemical analyses were evaluated as a function of the composition of the atmosphere. An increase in welding speed from 6 to 12 in./min permitted welding titanium in helium atmospheres containing up to 1% contaminant without deleterious effect on tensile and bend properties. Curves of hardness vs. nitrogen content and hardness vs. oxygen content were obtained for titanium buttons melted in helium atmospheres containing nitrogen and oxygen singly. It is hoped this information will aid in the evaluation of weld properties. (For preceding period see WAL-401/155-7.) (auth)

5584

MAGNETIC INVESTIGATIONS OF INTERNAL STRESSES. 1. INTERNAL STRESSES IN THE STRETCHING OF NICKEL WIRE. Fritz Forster and Kurt Stambke. Translated from Z. Metallkunde 33, 98-104(1941). 17p. (AEC-tr-1938)

The development of internal stresses in Ni wire after various heat treatments and after increasing tensile stresses was determined by means of the ferrograph. The initial susceptibility, magnetic detection of the onset of plastic deformations as the external stress is increased, direction of flow phenomena at the onset of flow, and the true physical yield point are given. (J.A.G.)

5585

MAGNETIC INVESTIGATIONS OF INTERNAL STRESSES. 2. INTERNAL STRESSES IN DIE-DRAWN NICKEL WIRE. Fritz Forster and Kurt Stambke. Translated from Z. Metallkunde 33, 104-14(1941). 22p. (AEC-tr-1939)

The influence of the stress distribution in a die-drawn Ni wire upon the magnetization loop is discussed using ferrograph photographs. The relationship between internal stresses and tension-induced change in remanence in die-drawn Ni wire is calculated in order to provide a quantitative evaluation of the photographs. Annealing was used to trace the breakdown of the internal stresses within die-drawn wires in which a decrease of internal stresses was observed. The development of internal stresses in die drawing and the decrease of stresses due to stretching die-drawn wires are discussed. (J.A.G.)

5586

INFLUENCE OF THE METHOD OF CASTING ALUMINUM ON THE DISTRIBUTION OF THE IMPURITIES AND THE APPEARANCE AFTER ANODIC OXIDATION. H. Richaud. Translated by Yvette De Felice from Rev. met. 51, 13-16 (1954). 9p. (AEC-tr-1944)

5587

THE USE AND SCOPE OF IRIDIUM 192 FOR THE RADIOGRAPHY OF STEEL. R. Halmshaw (Armament Research Establishment, London, England). Brit. J. Appl. Phys. 5, 238-43(1954) July.

The radiographic techniques and scope of application of Iridium^{192} for the radiography of steel are discussed. Sensitivities obtainable have been calculated from the experimentally determined effective absorption coefficient and the ratio of scattered to direct radiation intensities; these sensitivities have been confirmed experimentally. An attempt has been made to assign an equivalent x-ray kilovoltage to the radiation. The definition obtainable and its importance with different types of flaw have been discussed, and from this data the ranges of thickness of welds and castings on which satisfactory flaw-sensitivity should be obtained have been suggested. (auth)

5588

POWDER METALLURGY OF ZIRCONIUM AND BERYLLIUM. H. H. Hausner and H. B. Michaelson (Sylvania Electric Products, Inc., Bayside, N. Y.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 11-21 (1954).

The preparation of Zr powder by the vacuum decomposition of Zr hydride at 800°C or above, Zr and Zr hydride compacting and sintering, and properties of sintered Zr are reported. The effect of compacting pressure, sintering time, and sintering temperatures on the density of specimens made from Zr hydride is described. The grain growth of Zr during sintering was found to be very rapid when Zr hydride is the starting material, being most rapid from 1100 to 1200°C. The influences of O_2 content, grain size, and density on hardness of Zr are discussed. Hardness is shown as a function of sintering time and compacting pressure at 990°C. Optimum properties appeared to be obtained with compacting pressures of 40 to 50 Tsi when the hydride compacts are sintered in graphite in vacuum from 1150 to 1260°C. Beryllium powder preparation from vacuum-cast billets by lathe chipping and melting in a protective atmosphere, compacting in a steel die in a hydraulic press at about 15 to 90 Tsi, and a comparison of A-sintered and vacuum-sintered compacts are described. Vacuum sintering resulted in higher densities under similar temperature conditions, and the densities are practically independent of compacting pressures, whereas strong dependency during A sintering was observed. Electrical resistivity measurements of the vacuum-sintered compacts made from 200 to 1200°C with the densities obtained at the same sintering stage show that density does not change below 1000°C, but electrical resistivity decreases from the beginning of sintering. The high rate of evaporation of Be during vacuum sintering is discussed. Comparisons of recrystallization and grain structure of A-sintered and vacuum-sintered Be are given. Microstructure observations showed that recrystallization has already occurred at 1000°C and grain growth is present at 105°C. Although A-sintered Be is brittle, vacuum-sintering shows some ductility and can be cold rolled. Hot pressing and warm pressing of Be are briefly discussed. (J.A.G.)

5589

MELTING AND FABRICATION OF ZIRCONIUM. J. W. Holladay and J. G. Kura (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 23-30(1954).

Because of its reactivity with atmospheric gases and all known crucible refractories, zirconium must be consolidated by the special technique of arc melting in a furnace equipped with a water-cooled copper crucible. For production of large-scale ingots, a consumable electrode is preferable to an inert electrode. Zirconium can be forged and rolled readily in air with conventional equipment. It can be extruded to rod and tubing and can also be spun, cupped, and drawn. Machining characteristics are similar to those of aluminum. Joining is achieved by soldering, brazing, and welding. Zirconium may be contaminated by oxygen, nitrogen, carbon, or hydrogen during processing. Oxygen, nitrogen, and carbon strengthen zirconium at room temperature, but the strengthening is lost upon heating to relatively low temperatures; consequently, zirconium has good hot-working characteristics. It is not contaminated during the short time required to complete hot-working operations. Resistance to corrosion of zirconium is excellent in acid, alkali, and metal chlorides. Its resistance to hydrochloric and phosphoric acids is outstanding, but it is not resistant to sulfuric acid in concentrations greater than 80%. New nonreactor uses of ductile zirconium will probably be based on the excellent corrosion resistance of zirconium. (auth)

5590

ELECTROCLADDING OF REACTOR MATERIALS. John G. Beach and Charles L. Faust (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 31-8(1954).

The electrocladding of Al, Be, Mg, and Zr for use as reactor materials is discussed. Surface preparation (machining, surface finishing, and activation) is described. Baths and conditions for Ni plating of Al, Be, and Zr, Fe plating and Cr plating of Be and Zr, and Bi plating of Al are given. A very brief review of the advantages of Al as a cladding material is given. Photomicrographs of Ni-cladded Be are shown. Diffusion-alloying of clad Zr and Be and its effect on bonding are briefly discussed. (J.A.G.)

5591

PREPARATION, PROPERTIES, AND USES OF BERYLLIUM. E. J. Boyle and J. L. Gregg (Oak Ridge National Lab., Tenn.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 53-6(1954).

The properties and preparation of Be are discussed, including corrosion resistance to atmosphere and water,

solubility in hydrochloric, sulfuric, and nitric acids, mineral beryl ($Be_3Al_2Si_6O_8$) sources, preparation by reduction of a molten mixture of NaCl and BCl_2 and Mg reduction of BF_2, vacuum melting, crushing, powder compacting by vacuum hot pressing, mechanical properties of vacuum-hot-pressed Be before and after warm and hot extrusion, and its uses as a moderator in reactors. (J.A.G.)

5592

THORIUM METALLURGY. J. R. Keeler (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 57-61(1954).

Thorium can be produced by the reduction of its oxide or fluoride with alkali metals, and massive metal has been obtained by the DeBoer iodide process. Being ductile, the metal can be mechanically worked by most of the usual metal-working processes. The physical and mechanical properties of thorium are summarized, and several alloy systems are discussed. (auth)

5593

X-RAY STUDY OF REVERSION PHENOMENA IN ALLOYS OF Al-Cu WITH 4% Cu. René Graf and André Guinier. Compt. rend. 239, 52-4(1954) July 5. (In French).

Reversion treatment causes the dissolution of GP 1 zones, but has no effect upon the θ'' phase produced previously. In the course of subsequent aging, the formation of zones is retarded, but the development of θ'' is favored. (tr-auth)

5594

ANODIC BEHAVIOR OF ALUMINUM AND ITS ALLOYS IN SULFURIC ACID ELECTROLYTES. Ralph B. Mason and Phyllis E. Fowle (Aluminum Research Labs., New Kensington, Penna.). J. Electrochem. Soc. 101, 53-9(1954) Feb.

The main factors affecting the rate of solution of anodic oxide coatings on aluminum as they are being formed in sulfuric acid electrolytes are reported. Conditions favoring high coating ratios or thick, hard abrasion-resistant coatings have been investigated. Low temperatures, high current densities, which permit a shorter time of immersion in the electrolyte, and the addition of substances such as oxalic acid to the electrolyte favor the formation of such coatings. This has been mainly an investigation of the competition between the rate of formation and the rate of solution of the coatings. (auth)

5595

RATE OF OXIDATION OF THREE NICKEL–CHROMIUM HEATER ALLOYS BETWEEN 500° AND 900°C. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Research Labs., East Pittsburgh, Penna.). J. Electrochem. Soc. 101, 163-70(1954) Apr.

Rates of oxidation of three heater alloys of nominal composition 80% nickel–20% chromium were studied over the temperature range of 500 to 950°C and at a pressure of 7.6 cm of Hg of oxygen, using the vacuum microbalance method. Temper color films were obtained for all oxidations below 850°C, while gray or gray-green films were obtained at temperatures of 850°C and higher. No evidence was found for sealing or cracking of the oxide from the alloys on cooling at temperatures of oxidation up to 950°C. The parabolic rate law was applied to the data. Reasonable agreement was found for temperatures above 650°C, while below this temperature the parabolic rate law constant varied with time. This time variation was explained in terms of composition changes in the oxide and growth of the oxide crystallite size. The classical theory of diffusion was used to interpret effect of temperature on rate of oxidation, and heats, entropies, and free energies of activation for the over-all reaction were evaluated from the data. Heats of activation varied from 38,150 cal/mole for alloy 12046 to 51,400 cal/mole for alloy 13246, while the entropies of activation varied from −15.8 entropy units (eu) for alloy 12046 to −3.5 eu for alloy 13246. On an absolute basis, alloy 12246 had the slowest rate of attack with oxygen under the given conditions. This was not in agreement with the results of A.S.T.M. life tests. When compared to other metals, chromium reacted 4.1 times and nickel 12.6 times as fast with oxygen as alloy 13246. Calculations were made on the entropy of vacancy formation assuming that the reaction follows a mechanism of positive ion diffusion through vacancies created by the solution of oxygen at the oxide-gas interface. This gives an entropy term of −7.5 eu which partially accounts for the negative entropy of activation observed. Agreement of the theoretical rate of reactions with experiment was within a factor of 10 for all of the alloys. This difference is discussed briefly. (auth)

5596

ELECTRODEPOSITION OF BISMUTH. Kelso B. Morris, Dolores Z. Douglass, and Clarence B. Vaughn (Howard Univ., Washington, D. C.). J. Electrochem. Soc. 101, 343-7(1954) July.

Bismuth metal of high purity has been electrodeposited from molten mixtures of bismuth trioxide (10 and 25%) and the eutectic mixture of sodium and calcium chlorides. The rate of metal recovery (g/hr) is good. Energy consumption, based solely on the electrolysis and not on the furnace requirements, is approximately 1 kwh/lb of bismuth. (auth)

5597

ELECTRONIC CONFIGURATION IN ELECTRODEPOSITION FOR AQUEOUS SOLUTIONS. I. THE EFFECT OF IONIC STRUCTURES. Ernest H. Lyons, Jr. (Univ. of Illinois, Urbana). J. Electrochem. Soc. 101, 363-75(1954) July.

Consideration of electronic structures of metal ions in aqueous solutions indicates that metals are electrodeposited from ions in which coördinate linkages involve only orbitals of the outermost electronic shell. When coördination involves the penultimate shell also, that is, with Taube's "inner obital" complexes, the metal is not electrodeposited. Apparently the energy required to break such hybridization exceeds that required for cathodic discharge of hydrogen from these solutions. Platinum metals are exceptions, probably because of extraordinary stability of the metallic state for these elements; deposition, however, requires high activation, as shown by overpotentials and low current efficiencies. Between different oxidation states, electrolytic oxidation or reduction is irreversible if the electronic configuration must be changed significantly. Irreversible deposition is observed for transition metals or when the ion is bound in a hydrolyzed aggregate. Since inner orbital hybridization is associated with a lack of substitutional lability of the coördinated groups, whereas lability of outer orbital complexes probably results from formation of a dissociation intermediate, it is likely that such an intermediate is also important in the cathode process. These considerations are used to account for and extend the Piontelli electrolytic classification of metals. In considering the effects of anions, it is shown that aqueous complexes are reduced with highest irreversibility, which is attributed to high activity of water; the influence of halide ions may be labilization by the trans effect. (auth)

5598

ELECTRONIC CONFIGURATION IN ELECTRODEPOSITION FROM AQUEOUS SOLUTIONS. II. THE DEPOSITION PROCESS. Ernest H. Lyons, Jr. (Univ. of Illinois, Urbana). J. Electrochem. Soc. 101, 376-81(1954) July.

It is proposed that electrodeposition proceeds through an intermediate complex ion adsorbed on the cathode by a coördinated bridge. Subsequently, the bridge is eliminated, and a metallic bond established. By applying Pauling's

theory of the metallic state, reversible deposition of post-transition metals and irreversible deposition of transition metals are explained. A close correlation with electron-transfer reactions is shown. Inclusions in deposits represent residual coördinated groups, in agreement with results of recent studies. (auth)

5599

ELECTRON-DIFFRACTION STUDY OF LIQUID-SOLID TRANSITION OF THIN METAL FILMS. Mieko Takagi (Tokyo Inst. of Tech., Japan). J. Phys. Soc. Japan 9, 359-63(1954) May-June.

Structure changes of thin films of Pb, Sn and Bi at various temperatures have been studied by the electron diffraction method. The films were prepared in the electron diffraction camera by evaporating the metals on cleavage surfaces of several kinds of crystals. The mean thickness of the films ranged from 10 to 1000A. The observed melting points are found to be lower than those of bulk metals. Anticipating this effect to be attributed to the small size of the crystal, the melting temperature was calculated as a function of crystal size. The observed values of the lowering of the melting point agree fairly well with the calculated values for the crystal sizes estimated from the mean thickness and the breadth of the Debye-Scherrer rings in diffraction patterns. On cooling, the films are supercooled down to considerably lower temperatures which can be ascribed to the slowness of the rate of nucleation in a small crystal. (auth)

5600

THE CREEP PROPERTIES OF 99.8% PURITY ALUMINIUM AT 20-80°C. AND AT 250 AND 450°C. J. McKeown, R. Eborall, and R. D. S. Lushey. Metallurgia 50, 13-15(1954) July.

Prolonged creep tests at 20, 50, 80, 250, and 450°C on 99.8% aluminum have provided data from which design stresses may be obtained. At the two highest temperatures the effect of grain size on the creep behavior has been shown to be quite marked. (auth)

5601

A METHOD FOR THE ELECTROLYTIC ETCHING OF ALUMINIUM FOR MICROSCOPIC EXAMINATION. P. A. Raine, H. J. Ellis, and L. W. Terry. Metallurgia 50, 45-6, 52(1954) July.

5602

THE CONSTITUTION OF THE COPPER-RICH COPPER–ALUMINIUM–TIN ALLOYS, WITH SPECIAL REFERENCE TO TERNARY COMPOUND FORMATION. J. S. L. Leach and G. V. Raynor (Univ. of Edgbaston, Birmingham, England). Proc. Roy. Soc. (London) A224, 251-9(1954) June 22.

The constitution of copper-rich copper–aluminum–tin alloys has been examined by metallographic and x-ray methods in order to investigate the nature of a suspected ternary phase stable at temperatures below that of the eutectoid decomposition in the copper–aluminum system. The existence of a ternary phase T has been established, and isothermal diagrams have been established at various temperatures between 650 and 505°C. The characteristic of the ternary phase is a constant copper content of approximately 75 atomic %, which is maintained despite a wide variability in the tin and aluminum contents. At 505°C its structure is body-centered cubic, but at lower temperatures the phase splits up into two phases of different crystal structure (β' and Γ). The structure of the low-temperature β' phase formed below a tin content of 6.3 atomic % is ordered body-centered cubic, and the unit cell contains 16 atomic sites. The Γ phase has a small range of homogeneity in the region of 11 to 13 atomic % of tin, and its crystal structure is very similar to that of the δ phase in the copper–tin system. At intermediate compositions β' and Γ exist together at the lower temperatures. Accurate density measurements show that the T phase contains vacant atomic sites, which increase in number as the tin content increases. The difference between the low-temperature structures formed from T is to be attributed to this development of defects. The results are discussed with particular reference to the factors affecting the formation of the T phase, and the conditions under which ternary compounds may be expected in alloys of copper and silver with elements of the B subgroups of the periodic table. (auth)

PHYSICS

5603

Little, Arthur D., Inc.

LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. SUPPLEMENT NO. 3. [1953] 7p. (NP-4859(suppl.3))

5604

Little, Arthur D., Inc.

LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. SUPPLEMENT NO. 4. [1954] 5p. (NP-4859(suppl.4))

5605

Carnegie Inst. of Tech.

RESEARCH ON THE ELECTRONIC CONFIGURATION IN THE FERROMAGNETIC MATERIALS. FINAL REPORT. Emerson M. Pugh. July 1954. 35p. Contract Nonr-206(00). (NP-5260)

The ordinary Hall coefficients for Cu, Ni, Co, and the binary alloys of these elements, agree to within a factor of two with predictions based upon the usual band model in which the number of conduction electrons per atom is postulated to be the number, $n_s = 0.6$, of 4s electrons required to explain the saturation magnetization in these materials. The factor of two, however, created a dilemma, since both the magnetization data and the Hall data were accurately determined. The Hall results appeared to require that $n_s < 0.3$ whereas the magnetization data requires that $n_s > 0.54$. It will be shown that this dilemma disappears when the 4s band is considered divided into two parts in which the electrons with spins parallel to the spontaneous magnetization have much greater mobility than those with spins antiparallel. According to Mott the antiparallel electrons have low mobility, because they can be scattered into the partially empty 3d band, whereas the parallel electrons cannot. It will be shown that the ordinary Hall data, the saturation magnetization data, and the resistivity data for these transition elements and their alloys, can be made understandable by employing a four band model, consisting of two 4s bands and two bands from the 3d shell. (auth)

5606

Atomic Energy Project, Univ. of Calif., Los Angeles

AN EMPIRICAL TREATMENT OF THE POROSITY FUNCTION IN THE KOZENY EQUATION. W. C. Burke, Jr. and L. Baurmash. July 29, 1954. 17p. Contract AT-04-1-GEN-12. (UCLA-300)

An empirical treatment of the porosity function of the Kozeny equation has been developed. This porosity function was found to give more consistent results over a wider range of porosities than the usual form used in the Kozeny equation. (auth)

5607

MEASUREMENT OF SPECIFIC HEAT OF METALS AT VERY LOW TEMPERATURES (CADMIUM FROM 0.3 TO 0.9°K). B. N. Samoilov. Translated from Doklady Akad. Nauk S.S.S.R. 86, 281-4(1952). 8p. (AEC-tr-1024)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-3797.

5608

PERMANENT MAGNETS OF BARIUM OXIDE AND FERRIC OXIDE. H. Fahlenbrach and W. Heister. Translated from Arch. Eisenhüttenw. 24, 523-8(1953). 20p. Available from Henry Brutcher (Trans. No. 3229), Altadena, Calif. (AEC-tr-1937).

Work on isotropic and anisotropic permanent magnets of the chemical composition $BaO \cdot 6Fe_2O_3$ is reported. Demagnetization curves and data on the temperature dependence of induction and magnetic saturation of the magnet are given. (J.S.R.)

5609

ENERGY BAND SHAPES AND BAND WIDTHS IN METALS. S. Raimes (Imperial College, London). Phil. Mag. 45, 727-34(1954) July.

The density of states curve given by the recent theory of Bohm and Pines is compared with those of the Sommerfeld and Hartree–Fock theories. It is found that the Bohm and Pines curve shows a rudimentary 'tail', and the effect of this on the interpretation of the experimental soft x-ray emission data is discussed, with particular reference to the metals sodium, magnesium and aluminium. Although the Bohm and Pines band width is a great improvement on that of the Hartree–Fock theory, it is still much larger than the observed width. It is suggested that this may be partly due to the neglect of the short-range correlation energy: a lower bound to the narrowing of the band from this cause is calculated, and found to be 0.1 ev for sodium. (auth)

5610

ULTRA-HIGH FREQUENCY BEAM ANALYZER. L. R. Bloom and H. M. VonFoerster (Univ. of Illinois, Urbana). Rev. Sci. Instr. 25, 649-53(1954) July.

This paper describes a method for presenting on a fluorescent screen the time-varying velocity and density modulation of an electron beam, modulated at a frequency of 3000 Mc, as it emerges from the cavities of a klystron, the wave guide in a traveling wave tube, or similar structures. In order to deflect an electron beam at this frequency, each pair of the usual deflection plates is replaced by a two-wire transmission line, resonant at the beam-modulating frequency. Under proper phase conditions a circular trace is obtained, where one complete revolution of the beam corresponds to exactly one complete cycle of events on the beam at the point of its deflection. Since electrons having different velocities will be deflected differently, a complete velocity and density picture of the beam at a given point of interest is obtained. This is demonstrated by observing the bunching action in the drift region of a velocity-modulated electron beam. (auth)

COSMIC RADIATION

5611

ON A HIGH ENERGY COLLISION IN A NUCLEAR PLATE. M. Teucher. Helv. Phys. Acta 27, 179-80(1954) June. (In German).

In nuclear emulsions exposed at a height of 30 km, a star of the type 29 + 221 was found. In the 221 shower particles, at best only 10% were protons. The energy of the primary particle was determined to be 70 bev/nucleon. Four secondary stars were found, the average energy of which was 1 bev. (J.S.R.)

5612

AN ACCOUNT OF THE "T TRACKS" IN NUCLEAR EMULSIONS. A. De Marco and A. Milone (Univ. of Genoa, Italy). Nuovo cimento (9) 12, 99-102(1954) July. (In Italian).

To clear up the problem of the so-called "T tracks", it is interesting to know the maximum value R_0 of the distances r between a black track ending in the emulsion and a minimum track, when the association between the two tracks is a surely established physical event. This maximum value was determined in the case of $\mu \rightarrow e$ decays, and it was found that 90% of the distances r are contained in the range 0 to 0.6 μ. The distribution of the distances r in the case of the T tracks was compared in the range 0 to R_0 with the experimentally determined distribution of random coincidences. The close similarity of the two distributions shows that no evidence exists of the occurrence of noncasual T tracks. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5613

Laboratory for Insulation Research, Mass. Inst. of Tech. THE LATTICE CONSTANTS OF THE ALKALI BOROHYDRIDES AND THE LOW-TEMPERATURE PHASE OF SODIUM BOROHYDRIDE. S. C. Abrahams and J. Kalnajs. July 1954. 9p. Contracts N5ori-07801 and N5ori-07858, Technical Report No. 80. (NP-5263)

The lattice constants of sodium, potassium, rubidium, and cesium borohydrides have been measured at 25.0°C as 6.1635 ± 0.0005, 6.7272 ± 0.0005, 7.029 ± 0.001, and 7.419 ± 0.001A, respectively. All four crystals are face-centered cubic and have the sodium chloride structure. Below the transition point (–83°C) sodium borohydride becomes tetragonal with lattice constants of a = 4.354 ± 0.005 and c = 5.907 ± 0.005A at –195°C. (auth)

5614

Laboratory for Insulation Research, Mass. Inst. of Tech. THE CRYSTAL STRUCTURE OF BARIUM PEROXIDE. S. C. Abrahams and J. Kalnajs. 15p. Bound with Technical Report No. 80 (NP-5263). Contract N5ori-07801, Technical Report No. 81. (NP-5264)

The lattice constants of barium peroxide have been remeasured, and at 25.0°C the tetragonal unit cell has a = 5.384 ± 0.010 and c = 6.841 ± 0.005A. The crystal structure has been redetermined, using a complete least-squares method, as well as triple Fourier series, based upon powder-derived intensities measured with a Geiger counter. The oxygen–oxygen bond length is 1.49 ± 0.04A, and there are two kinds of barium–oxygen contacts of 2.68 and 2.79A. The final agreement factor R_t has the value 0.0381. (auth)

5615

Laboratory for Insulation Research, Mass. Inst. of Tech. A MAGNETO-X-RAY STUDY OF MAGNETITE AT 78°K. S. C. Abrahams and B. A. Calhoun. July 1954. 10p. Bound with Technical Report No. 80 (NP-5263). Contracts N5ori-07801 and N5ori-07858, Technical Report No. 82. (NP-5265)

The x-ray-diffraction pattern produced by a small single crystal of magnetite after cooling through the transition at 119°K has been examined. It is demonstrated by using orientated magnetic fields during the cooling process that up to six different domain orientations are present in the crystal at 78°K. This number of domain orientations can be produced only if the symmetry of the low-temperature phase of magnetite is orthorhombic or lower. (auth)

5616

Evans Signal Lab., Signal Corps Engineering Labs. SOLIDS SUBJECTED TO A CONSTANT RATE OF GENERATION OF LATTICE DEFECTS. Jerome Rothstein. Oct. 15, 1953. 76p. (SCEL-E-1127; AD-25284)

Consequences are derived from the assumption that a damage process contributes to the rates of formation and destruction of defects. The steady-state defect densities, taking damage and thermal mechanisms into account, are calculated for Frenkel and Schottky defects and generalized to the simultaneous presence of different kinds of defects obey-

ing different order kinetics. In general, intervals of retrograde dependence of defect density on temperature occur, giving rise to anomalies in thermal expansion, specific heat, diffusion (including possible deviation from the Einstein relation between mobility and diffusion constant), ionic conductivity, electronic, optical, and chemical properties. With simple modification the theory becomes applicable to cooperative phenomena, leading to the existence of anti-Curie points (temperature below which disordered phases is stable), to description of many phenomena in semiconductors and phosphors and of cases of steadily perturbed equilibria such as occur in magnetic resonance experiments. The possibility of defect induced allotropy, work softening of damaged material, damage analogues of quenching including an anti-quench from low temperature, and damage induced solubility are predicted. Brief discussions are given of the approach to the steady state, a comparison of the thermal spike picture of damage with the defect approach, of the approximations employed, and of the connection between this paper and the thermodynamics of metastability and of open systems. In an appendix new kinds of defect and defect production mechanisms are proposed. (auth)

5617

SOME OBSERVATIONS ON HETEROGENEOUS NUCLEATION OF SODIUM CRYSTALS FROM ATOMIC BEAMS. L. Yang, C. E. Birchenall, G. M. Pound, and M. T. Simnad (Carnegie Inst. of Tech., Pittsburgh, Penna.). Acta Met. 2, 462-9(1954) May.

A vapor effusion apparatus was developed to measure critical supersaturation ratios for nucleation of metal crystals on various substrates. Deposition from sodium vapor beams was studied as a function of temperature and lattice misfit between the body-centered cubic sodium crystal and the various crystalline substrates. These substrate surfaces probably were coated with adsorbed gas films. The critical supersaturation ratios for the deposition of sodium are very high, ranging from 10^{19} at 159°K to 10^{11} at 213°K. The data are fitted by a rate equation whose kinetic coefficient was derived on the basis of an adsorption and surface diffusion mechanism. This treatment leads to an evaluation of the standard free energy of adsorption of the metal atoms. The critical nucleus size is calculated from the data to be about the size of a unit cell (9 Na atoms). The potencies of the metal substrates (face-centered cubic, Ag, Pt, Cu and Ni) for catalysis of nucleation are about the same. The potency of CsCl (body-centered cubic) is much higher than that of the metal substrates, possibly indicating a smaller gas adsorption on the CsCl surface. However, there is a small decrease in catalytic potency with increase in disregistry at the higher temperatures in qualitative agreement with the Turnbull-Vonnegut theory. (auth)

ELECTRONS

5618

David Sarnoff Research Center

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY PROGRESS REPORT NO. 15 [FOR] FEBRUARY 1, 1954–MAY 1, 1954. ON THE MEASUREMENT OF THE AVERAGE TIME SPREAD IN SECONDARY EMISSION. M. H. Greenblatt. [June 24, 1954]. 35p. Contract W-7405-eng-26, Subcontract 308. (AECU-2920)

An experiment has been performed which investigates in a direct manner the time-dispersion effect of secondary emission on short pulses of electrons. The results are, briefly, that pulses of secondary electrons as short as 1.3×10^{-10} sec have been measured. These pulses were produced by pulses of primary electrons which were 6×10^{-11} sec long. This broadening of 7×10^{-11} sec is shown to be at least partly due to transit time dispersion. The time dispersion due to the secondary emission process itself must, therefore, be less than 7×10^{-11} sec. (For preceding period see AECU-2883.) (auth)

5619

THE STATE OF POLARIZATION IN BREMSSTRAHLUNG RADIATION. Christophe Tzara. Compt. rend. 239, 44-7 (1954) July 5. (In French).

The existence of photon polarization in the bremsstrahlung spectrum of 22-Mev electrons is experimentally demonstrated. (tr-auth)

GASES

5620

INFLUENCE OF THERMAL IONIZATION ON THE DISTRIBUTION OF PARTICLES IN A NON-UNIFORMLY HEATED GAS. A. A. Abrikosov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 22, 321-30(1952). 11p. (AERE-Trans-11/3/5/303; AEC-tr-1613)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-1161.

5621

CALCULATION OF THE ENERGY PER ION PAIR FOR α-PARTICLES IN HELIUM. G. A. Erskine (Univ. Coll., London). Proc. Roy. Soc. (London) A224, 362-73(1954) July 7.

The average energy per ion pair, W, for the ionization of helium by 1 to 6 Mev α particles is calculated using the Born approximation, the number of ion pairs produced by secondary, tertiary, etc., electrons being calculated from an integral equation which is solved numerically. The calculated W is nearly constant over this energy range, with average W = 41.1 ev. This agrees well with the value, W = 42.7 ev, measured recently by James & Sadauskis for 5.3 Mev-α particles in helium, and supports their suggestion that the earlier measured values of W for α particles in helium may have been spuriously low owing to the presence of small amounts of other gases. (auth)

INSTRUMENTS

5622

Raw Materials Development Lab., American Cyanamid Co., Atomic Energy Div.

A NEW FLUORIMETER FOR THE DETERMINATION OF URANIUM. Paul Galvanek, Jr. and Thomas J. Morrison, Jr. May 27, 1954. 39p. Contract AT(49-1)-533. (ACCO-47)

A new fluorimeter of good precision is described using fluorescent-type ultraviolet lamps as the irradiation source. This has permitted simplification of construction and consolidation of components. The result is a compact, rugged instrument, easily portable, having simple, fast, reliable operation. Substantial reduction in cost is effected. The instrument, consisting of a console and a power supply, is applicable for research as well as for routine control operation. When used in conjunction with the fluorimetric analytical method employed at the Winchester Laboratory, uranium analyses with an average accuracy of within 2% and an average reproducibility of within 3% are obtained over the range of 4×10^{-5} to 2×10^{-4} g of U_3O_8. Provision has been made to permit measurement of fluorescent disks produced with the 2 most common fluxes employed in the fluorimetric determination of uranium. (auth)

5623

Commissariat à l'Énergie Atomique (France)

UTILISATION RATIONNELLE D'UN SPECTROMETRE DETECTEUR DE FUITES. [REASONABLE UTILIZATION OF A SPECTROMETER LEAK DETECTOR]. R. Geller. Apr. 1954. 17p. (CEA-256)

The general problem of leaks in a vacuum system is dis-

cussed. The principles of detection in general and particularly the conditions of detection with spectrometers using He were studied. Practical applications of a spectrometer leak detector are given. (tr-auth)

5624

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

A COUNT RATE CIRCUIT WITH A GROUNDED OUTPUT. L. Cathey. Aug. 1954. 10p. Contract AT(07-2)-1. (DP-71)

A count-rate meter is described with full scale ranges of 10, 100, and 1,000 counts per second. The output of the count-rate circuit has one side grounded so that it can be used with a servo-recorder. Response times of 10 milliseconds to 100 seconds are possible. (auth)

5625

Ames Lab.

AN ELECTRONIC VACUUM DILATOMETER. M. E. Dooley and D. F. Atkins. June 17, 1954. 26p. Contract W-7405-eng-82. (ISC-482)

A vacuum dilatometer based on the use of a linear variable differential transformer was constructed. Expansion or contraction of the specimen moves a silica pusher-rod which, in turn, changes the position of the core of the linear transformer. The output of the transformer is directly proportional to the displacement of this core. Hence, any change in the length of the specimen appears as a change in the output potential of the linear transformer. The output is amplified, rectified, and fed into the chart-moving circuit of a function-plotting potentiometer. The transformer is supplied by a 2,000 cps oscillator. Schematic diagrams of the electronic equipment are included. The instrument was used for about a year for the detection of solid phase transformations in alloys. By varying the input voltage to the transformer, the size of the expansion curves can be increased or decreased as desired. Several curves are reproduced to illustrate the performance of the instrument. (auth)

5626

Los Alamos Scientific Lab.

AUTOMATIC ALIGNING LIGHT, SHUTTER, AND PLATE RACKING CONTROLS FOR THE BAUSCH AND LOMB LARGE LITTROW SPECTROGRAPH. Jack M. Gillette. Mar. 1952. 17p. Contract W-7405-eng-36. (LA-1676)

Automatically controlled shutter and plate racking mechanisms are described. The shutter control may be operated manually by means of push-button switches or automatically by means of a photoelectric tube circuit which is activated by light from the source. This photoelectric tube control system makes for more universal application since it is independent of the type of source. The plate racking may be controlled either manually or automatically at the end of the exposure cycle. The plate may be racked any pre-set distance between 2 and 6 mm consistently within 0.1 to 0.2 mm. The electrode alignment system, which is in line with the optical path, allows for continuous readjustment of electrode gap. Although designed for the Bausch and Lomb Large Littrow Spectrograph, the mechanism could be adapted to most manually operated instruments. (auth)

5627

Livermore Research Lab., Calif. Research and Development Co.

TIME INTERVAL INDICATOR. R. A. Manhart. May 1954. 10p. Contract AT-(11-1)-74. (LRL-127)

The time interval indicator measures the elapsed time occurring between the leading edges of two definite-sequence independent pulses, within the limits of 0.3 to 100 microseconds, and indicates this time on a direct-reading panel meter. The accuracy of this particular instrument is ±5 per cent of the reading or ±2 per cent of full scale, whichever is larger; the accuracy can be increased by regulating the power supply. Time intervals from −0.2 to +0.3 microseconds are indicated as 0.3 microseconds due to limitations of the circuits used. Under several conditions the indicated time may be drastically in error; internal monitor circuits are incorporated to detect and indicate such errors. Internal operation and calibration check circuits are provided to allow rapid operational checks of the instrument. (auth)

5628

Mound Lab.

AN INSTRUMENT FOR THE MEASUREMENT OF THE TIME OF FALL OF A PLUMMET IN A PRESSURE VESSEL. (FINAL REPORT). A. J. Rogers, J. W. Heyd, W. L. Hood, and J. A. Williamson. Feb. 27, 1952. 13p. Contract AT-33-1-GEN-53. (MLM-805)

An instrument is described which will detect the position of a plummet located within a pressure vessel and time its fall at terminal velocity with an accuracy reproducible to within ±1%. Two pairs of coincidence Geiger counters detect the position of the plummet containing a few millicuries of Co^{60} at two points during its fall. Coincidence pulses from the Geiger counters actuate a timer to measure the fall time. A novel method of preventing premature actuation of the timer by random coincidence pulses is described. (auth)

5629

Radiation Lab., Univ. of Calif., Berkeley

BALL POTENTIAL DETECTOR. C. N. Winningstad. Jan. 1952. 9p. Contract W-7405-eng-48. (UCRL-1652)

The r-f potential on a spherical conductor is measured by a voltage probe system which is essentially a capacity divider combined with a peak-reading voltmeter. An equation relating ball potential to detector output is derived. A detailed procedure is described for calibration of the device. (K.S.)

5630

A FLEXIBLE SINGLE-CHANNEL PULSE-AMPLITUDE ANALYSER. F. J. M. Farley (Auckland Univ. Coll., New Zealand). J. Sci. Instr. 31, 241-5(1954) July.

This instrument is designed for measuring the amplitude of voltage pulses with particular application in nuclear counting. An output pulse is obtained only when the input pulse has an amplitude lying between two preset limits, the lower limit being variable from 5 to 50 v and the interval between the limits being 0.5, 1, 2, 3, 5, or 7.5 v, selected by a switch. The instrument can also be used as a simple discriminator. A feature of this instrument is that without readjustment it can deal with a wide variety of input pulses ranging from 0.2 to over 1000 μsec in length. In all cases the dead time is only a few tenths of a microsecond. The design, which is unusually simple, includes a high-speed threshold amplifier, an improved high-speed discriminator circuit, and a new veto circuit. (auth)

5631

A STEREOSCOPIC REPROJECTION APPARATUS FOR NEUTRON SCATTERING EXPERIMENTS. M. H. Alston, A. V. Crewe, and W. H. Evans (Univ. of Liverpool, England). J. Sci. Instr. 31, 252-4(1954) July.

A cloud-chamber reprojection system is described which has been used in neutron scattering experiments with a point source of neutrons 20 in. away from the chamber. Scattering angles and ranges of recoil particles are measured directly. (auth)

5632

AN IMPROVED X-RAY SHADOW PROJECTION MICROSCOPE. V. E. Cosslett and H. E. Pearson (Cavendish Lab., Cambridge, England). J. Sci. Instr. 31 255-7(1954) July.

An apparatus for producing a point source of x rays, less than 1 μ in diameter, is described. A tungsten hairpin filament is employed, and two magnetic electron lenses

form a demagnified image of it on a metal foil which serves as both target and window. The tube is demountable; a variety of different targets has been employed (copper, silver, tungsten) for producing x rays of different characteristic wavelength. The maximum voltage applied has been 20 kv, but simple modifications would permit 30 to 40 kv to be used. The optimum conditions of operation are briefly discussed. The tube has been constructed primarily for the projection of x ray shadow images of small specimens. (auth)

5633

AN EASILY OPERATED FINE VOLTAGE CONTROL. H. House (Univ. of London). J. Sci. Instr. 31, 261-2(1954) July.

A modified circuit is shown which satisfies the conditions that the control should be fine, that no break should occur in the output circuit, and that there should be no abrupt increase of voltage anywhere in the range. The circuit has only one control, and safety devices are incorporated which prevent sudden application of voltage to the high-voltage transformer. (L.T.W.)

5634

A CHRONO-INTERFEROMETER FOR MEASURING GAS DENSITY DURING TRANSIENT FLOWS. C. W. Curtis, R. J. Emrich, and John Mack (Lehigh Univ., Bethlehem, Penna.). Rev. Sci. Instr. 25, 679-82(1954) July.

An interferometer for measuring gas density as a function of time during a transient flow is described. This is an absolute instrument capable of measuring density changes over an approximate range from 10^{-2} to 10^{-5} g/cm^3. Since the instrument requires only small optical components, it is relatively simple and inexpensive to construct. (auth)

ISOTOPES

5635

Atomic Energy Research Establishment, Harwell, Berks (England)

THE PREPARATION FOR DISPENSING OF MISCELLANEOUS RADIOISOTOPES. F. Hudswell, B. J. Miles, B. R. Payne, J. A. Payne, P. Scargill, and K. J. Taylor. Apr. 20, 1954. 10p. (AERE-I/R-1386)

The preparation for dispensing of the less commonly handled radioisotopes is described, including Ca^{45}, Cl^{36}, Cr^{51}, Fe^{55}, Fe^{58-55} and Fe^{59}, Na^{22}, Na^{24}, S^{35} (carrier-free, and low specific activity solid), Zn^{65}, colloidal radioactive palladium (Pd^{109}), and stable auricyanide complex containing Au^{198}. Improvements in the production of I^{131} and P^{32} are also described. (auth)

5636

RADIOISOTOPES IN INDUSTRIAL CONTROL. G. D. Calkins and Meyer Pobereskin (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 259-66(1954).

The applications of radioisotopes to industrial control problems are discussed. The utilization of radioactive techniques in the measurement of location and motion, the measurement of physical properties, the detection of flaws, the tracing of materials, and the determination of chemical composition are described. (auth)

ISOTOPE SEPARATION

5637

THE CONCENTRATION OF HEAVY NITROGEN ISOTOPE: THE CONCENTRATING EFFICIENCY OF PACKED COLUMNS AND MEASUREMENT OF LIQUID HOLD-UP IN THE PACKED COLUMNS BY RADIOACTIVE COBALT. Ryohei Nakane. Translated from Repts. Sci. Research Inst. (Japan) 28, 275-88(1952). [APPENDIX]: THE CONCENTRATION OF HEAVY NITROGEN. Ryohei Nakane. Translated from Repts. Sci. Research Inst. (Japan) 28, 413-14 (1952). 36p. (AEC-tr-1942)

Highly concentrated heavy N_2 was prepared by chemical exchange reactions in packed columns. The efficiency of the packed columns was determined by mass spectrographic means, and the results are compared with the theoretical calculations. (J.S.R.)

5638

SEPARATION OF ISOTOPES BY MEANS OF SURFACE DIFFUSION IN POROUS MEDIA. R. A. W. Haul (National Chemical Research Lab., Pretoria, South Africa). Naturwissenschaften 41, No. 11, 255-6(1954) June. (In English)

Two experiments are described for the separation of O isotopes by means of surfaces diffusion in linde silica. The experiments were carried out at 76.8 and 296.5°K and a pressure of 20.5 mm. In the first the diffusion coefficients are related by $D_{O^{18}O^{16}} = 0.84 D_{O^{16}O^{16}}$; in the second $D_{O^{18}O^{18}} = 0.976\ D_{O^{16}O^{16}}$. (J.S.R.)

MASS SPECTROGRAPHY

5639

Argonne National Lab.

A MASS SPECTROMETER FOR ROUTINE SOLID ANALYSES. C. M. Stevens and M. G. Inghram. Apr. 1954. 12p. Contract W-31-109-eng-38. (ANL-5251)

The basic instrument is a 12-in., 60° type mass spectrometer similar to that developed by Inghram. The tube, magnet, and vacuum system are mounted in a cabinet with the electronics located in relay racks. A complete technical description of the instrument and results of its operation are given. (L.T.W.)

5640

A MASS SPECTROGRAPH FOR THE ANALYSIS OF SOLIDS. N. B. Hannay (Bell Telephone Labs., Murray Hill, N. J.). Rev. Sci. Instr. 25, 644-8(1954) July.

A double-focusing mass spectrograph for the analysis of low concentrations of impurities in solids has been developed. The instrument is of the Mattauch type and is designed for either photographic or electrical ion detection. The construction and performance of the instrument are discussed. Bulk concentrations below 0.1 part per million, and surface contaminants of less than 0.1 monolayer, can be detected in short exposures using a photographic plate. (auth)

MATHEMATICS

5641

Chalk River Project (Canada)

TABLES OF COEFFICIENTS FOR ANGULAR DISTRIBUTION ANALYSIS. W. T. Sharp, J. M. Kennedy, B. J. Sears, and M. G. Hoyle. Dec. 1953. 81p. (CRT-556; AECL-97)

Tables of Z, Z_1, W, and X coefficients are presented in factored form for a range of parameters appropriate to the needs of the Chalk River electrostatic accelerator. In particular these tables suffice for most double correlation experiments involving particles with orbital angular momentum not larger than 4, or dipole, quadrupole, or octupole gamma radiation. Some of the coefficients are taken from previous tabulations whereas the remainder have been computed. The notation and range of the tables are discussed in the preface and the mathematical definitions of the coefficients in the introduction. A third introductory section lists formulas for the correlation of nuclear radiations and the angular distribution of nuclear reaction products in terms of the tabulated coefficients. (auth)

5642

Livermore Research Lab., Calif. Research and Development Co.

A COMPUTER FOR SOLVING PARTIAL DIFFERENTIAL

EQUATIONS. N. C. Ostrander, D. B. Moore, and E. R. Lind. June 1954. 20p. Contract AT(11-1)-74. (LRL-155)

A computer for solving elliptic and parabolic partial differential equations is described. These equations occur frequently in the description of electromagnetic, hydrodynamic, diffusion, and heat conduction phenomena. A simple machine is described in detail; some suggestions are offered for extending the simple machine to quite complex problems. Comparisons are made between the use of the proposed machine and alternative methods such as network analyzers and digital computers. (auth)

5643

Radiation Lab., Univ. of Calif., Berkeley

UCRL LECTURES ON NUMERICAL ANALYSIS AND APPLIED MATHEMATICS. LECTURE IX. Edward S. Robbins. Nov. 18, 1952. 21p. Contract W-7405-eng-48. (UCRL-2149)

The theory of nomographs and alignment charts is discussed. (K.S.)

MEASURING INSTRUMENTS AND TECHNIQUES

5644

Chemical and Physical Labs., Federal Telecommunications Labs., Inc.

IONIZATION-CHAMBER INSULATING MATERIAL. FINAL REPORT [FOR] JULY 15, 1951–JULY 15, 1953. H. G. Nordlin, D. K. Keel, and C. H. Mayhew. Oct. 1953. 265p. Contract DA-36-039-sc-5424. [A Continuation of work under Contract W-36-039-sc-44548]. (AD-20666)

Measurements of polarization current, radiation-induced conductivity, and irradiation after effects were made on a wide variety of dielectric materials. Polar materials such as PVC, polyparachlorostyrene, and polychlorotrifluoroethylene were characterized by a high dielectric absorption and a low radiation-induced conductivity. The nonpolar materials such as polystyrene and polytetrafluoroethylene had a low dielectric absorption and were affected to a much greater degree by high-energy radiation. A high increase in the purity of polystyrene resulted in an increase in the radiation-induced conductivity and a decrease in the dielectric absorption. For the nonpolar dielectrics, a decrease in conductivity occurred after a long period of irradiation. This was greatest for polytetrafluoroethylene where, at 100 r/hr, a conductivity peak was reached in about 1 hr, and the decrease was by a factor of about 6 after 200 hr. These effects appeared to be reversible, although an appreciable time may be required. The conductivity induced in nonpolar dielectrics by γ irradiation was nearly proportional to the square root of the irradiation dosage rate. The conductivity induced in polystyrene by 35- to 50-kev x-ray irradiation was similar to that occurring with 1300-kev γ irradiation. Measurements indicated an increase in conductivity with photon energy. The conductivity of polystyrene was ohmic in electric fields as high as 10^5 v/cm. Voltage breakdown tended to occur above this range for the samples tested. (ASTIA abst.)

5645

Atomic Weapons Research Establishment, Aldermaston, Berks (England)

THE SPECTRAL CHARACTERISTICS OF SOME ORGANIC FLUORS. G. W. King. Mar. 1954. 40p. (AWRE-0-12/54)

The energy distribution in the fluorescence spectra of various organic substances under excitation by ultraviolet radiation has been determined. Substances were studied both in the crystalline state and as solid solutions in plastics. The absolute quantum efficiencies of fluorescence have been measured. Certain results are discussed in terms of an energy transfer between components of mixed solid solutions by a dipole-dipole interaction process. (auth)

5646

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

THE SRP STANDARD WINDOWLESS FLOW COUNTER. C. A. Prohaska. Apr. 1954. 28p. Contract AT(07-2)-1. (DP-45)

The operating characteristics of the SRP standard windowless flow counter have been investigated. Alpha and beta plateaus are over 200 volts long with essentially zero slope. Reproducibility is good. The alpha background is satisfactory, but the beta background at best is high and variable. The coincidence correction is less than one per cent per 10^5 counts per minute. (auth)

5647

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

THE SRP STANDARD GEIGER-MUELLER COUNTER. C. A. Prohaska. May 1954. 27p. Contract AT(07-2)-1. (DP-61)

The operating characteristics of the SRP standard GM counter were investigated. Plateaus are at least 150 volts long, with essentially zero slope. Reproducibility and background are satisfactory for this type of counter. The coincidence correction is less than one-half per cent per 10^3 counts per minute. (auth)

5648

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.

A REMOTE-INDICATING BF_3 COUNTER SYSTEM. L. Cathey. June 1954. 14p. Contract AT(07-2)-1. (DP-63)

To provide a sensitive, remote-indicating detector for thermal neutrons, a special preamplifier was developed to permit the use of long signal leads. Five individual preamplifiers and cable systems were built which operate with a 40-foot cable between the BF_3 counters and the preamplifiers and a 150-foot cable between the preamplifiers and the scalers. All controls and power supplies were located near the scalers. The systems were designed so that standard scalers could be used. Tests showed that the systems functioned satisfactorily over the desired range and did not saturate completely even at observed counting rates as high as 10^6 counts per minute. There was a counting loss of about 35% at the high counting rates, which may have been caused by insufficient resolution of the scaler. (auth)

5649

Hanford Works

OPERATION AND MAINTENANCE INSTRUCTIONS FOR GAMMA SCINTILLATION MONITOR–MODEL 111. R. E. Connally. Oct. 1, 1953. 13p. Contract W-31-109-eng-52. (HW-29349)

5650

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF SOFT X-RAYS. FOURTH QUARTERLY PROGRESS REPORT [FOR] MARCH 1, 1952 TO JUNE 1, 1952. A. E. Caswell and James T. Nelson. 16p. Contract DA-36-039-sc-5599. (NP-5251)

The thallium-activated sodium iodide crystal has been successfully sealed from moisture. The output of the scintillation counter may be applied to an electronic microammeter or a counting-rate meter or a scaler, with suitable amplifiers. The peaks in the copper Kα spectrum have been resolved and their positions determined to within 0.5 minute using the 022 planes of an AT cut quartz crystal. The x-ray absorption seems to be primarily photoelectric. (auth)

5651

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR

THE DETECTION OF SOFT X-RAYS. FIFTH QUARTERLY PROGRESS REPORT [FOR] JUNE 1, 1952 TO SEPTEMBER 30, 1952. A. E. Caswell and M. Takeo. 12p. Contract DA-36-039-sc-5599. (NP-5252)

The analysis of the differential pulse-height curve shows that the number of photoelectrons at the photocathode, including the electron collector efficiency, of the photomultiplier per 8-kev x-ray quantum is about 7, that the effective efficiency of energy conversion in luminescence of the thallium-activated sodium iodide is 9%, and that the 5819 type photomultiplier in the measurement has an efficiency of 5% over the emission spectra of NaI(Tl) excited by x rays at room temperature. The glass plate window and quartz plate window, one of which will be necessary for a permanent mounting of the hygroscopic crystal, have been tested. The quartz plate is found to give a much better result due to less absorption. A mechanically powdered NaI(Tl) crystal was also tried, but gave no better results. Any heating and polishing treatment has resulted in a noisy crystal presumably due to the introduction of irregularities into the crystal. This places very strict restrictions on the selection of cements together with the hygroscopy. However, the NaI(Tl) crystal at a lower temperature seems to have a larger output. The current detection, instead of counting, of x rays is dependable if the number of photoelectrons per quantum incident on the scintillation system is more than 5. (For preceding period see NP-5251.) (auth)

5652

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF SOFT X-RAYS. SIXTH QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1, 1952 TO DECEMBER 31, 1952. A. E. Caswell. 11p. Contract DA-36-039-sc-5599. (NP-5253)

It was found that suitably mounted NaI(Tl) crystals remain stable for an indefinite period, but so-called "unmounted" crystals are not dependable. There is some differences among crystals apparently due to the nature of the surface, which should be quite smooth and covered with a thin film of oil to reduce surface reflections. The 6199 photomultiplier is about twice as efficient as the 5819 and is less bulky and more convenient to handle. Al, Cr, and MgO seem to be about equally good as reflecting surfaces inside the crystal container. Studies have been confined to the CuKα_2 x-ray line, using a nickel filter. (For preceding period see NP-5252.) (auth)

5653

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF SOFT X-RAYS. SEVENTH QUARTERLY PROGRESS REPORT [FOR] JANUARY 1, 1953 TO MARCH 31, 1953. James T. Nelson and Makoto Takeo. 9p. Contract DA-36-039-sc-5599. (NP-5254)

Additional scintillation crystals and photomultipliers have been tried and their efficiency checked in order to determine whether reproducible results can be obtained with scintillation counters. Curves showing the usefulness of the scintillation counter as an energy-measuring device for x rays are included. A comparison between the scintillation counter and a Geiger-Mueller counter for recording powder diffraction patterns is also included. (For preceding period see NP-5253.) (auth)

5654

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF SOFT X-RAYS. EIGHTH QUARTERLY PROGRESS REPORT [FOR] APRIL 1, 1953 TO JUNE 30, 1953. James T. Nelson and Makoto Takeo. 28p. Contract DA-36-039-sc-5599. (NP-5255)

A scintillation counter useful for efficient detection of x rays of energies in the vicinity of the copper Kα line and higher is described. A general consideration of the properties of NaI(Tl) and a method for hermatically sealing it into a permanent scintillation crystal unit are also given. The range over which the counter is useful and its application to energy measurement and to energy discrimination are covered. A comparison is made between a Geiger-Mueller counter and the scintillation counter in diffraction work. (For preceding period see NP-5254.) (auth)

5655

Oregon Univ.

INVESTIGATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF SOFT X-RAYS. FINAL REPORT [FOR] JULY 1, 1953 TO OCTOBER 1, 1953. James T. Nelson and Raymond T. Ellickson. 15p. Contract DA-36-039-sc-5599. (NP-5256)

Some additional work on the characteristics of the counter is described. It is shown that the counter gives a response which is linear over an intensity range of about one-half million, with no indication of a departure from linearity at the ends of this range, and that the average number of photoelectrons released at the photocathode of the photomultiplier tube, as determined from pulse-height distributions, is proportional to the energy of the x-ray photons for x rays varying in wave length from 0.6 to 2.5 A. By proper use of a discriminator circuit it is possible to adjust the counter so that it will respond to 97% of the pulses from CuKα while rejecting all but about 10% of the pulses from x rays of half that wave length, a feature which should be useful in using the counter for quartz orientation. By removing the upper limit on the discriminator the counter should give an essentially flat response to all x rays shorter than CuKα, a feature which should be useful in using the counter for x-ray fluorescence analysis. (For preceding period see NP-5255.) (auth)

5656

Naval Research Lab.

THE OPTICAL PROPERTIES OF A QUATERPHENYL-POLYSTYRENE SCINTILLATOR. C. F. Ravilious. June 30, 1953. 5p. (NRL-Memo-177)

5657

ON A "SLOW" IMPULSE SPECTROGRAPH FOR MEASUREMENT OF COSMIC RADIATION. C. Burckhardt (Univ. of Bern, Switzerland). Helv. Phys. Acta 27, 176-9(1954) June. (In German).

The design and construction of an impulse spectrometer for the measurement of cosmic radiation is described. (J.S.R.)

5658

A NOTE ON AVOIDING SCATTERED ELECTRONS FROM THE SPECTRUM OBTAINED BY MAGNETIC SPECTROMETER. Mitsuo Sakai (Tokyo Univ., Japan). J. Phys. Soc. Japan 9, 437-8(1954) May-June.

The elimination of scattered particles which do not correspond to momenta defined by the magnetic field of a spectrometer is achieved by the use of a scintillation counter with an appropriate discriminator bias setting. (K.S.)

5659

NON-FOCUSED CHERENKOV EFFECT COUNTERS. M. Mandò (Univ. of Florence, Italy). Nuovo cimento (9) 12, 5-27(1954) July. (In Italian).

The properties of nonfocussed Cherenkov effect counters are investigated, especially in view of their possible applications in cosmic-ray work. Attention is mainly concentrated on optical collection efficiency and its uniformity, time of response (defined as the rise time of the electrical pulse produced on the photocathode), large sensitive area,

and ability to distinguish between particles travelling in exactly opposite directions (which are called antidirectional property and are peculiar to Cherenkov detectors, owing to the intrinsic anisotropy in the emission of the Cherenkov light). Cherenkov detectors are classified into three classes according to the optical properties of the walls, namely, specular, diffusing, and mixed. For each class a typical geometry is discussed in detail, while resonable generalization of results is discussed in separate paragraphs. The main conclusions are that properly designed specular detectors, while easily exibiting good antidirectional properties and occasionally high collection efficiency, can hardly ensure uniformity of response with a sensitive area which be large compared to that of the photocathode; good antidirectional properties and uniformity of response can be best achieved with mixed counters, the optical efficiency being then uniformly low (not lower, however, than the efficiency of specular counters for particles impinging under the less favourable incidence); the often employed diffusing cone, however, does by no means appear to be the best solution; diffuse counters allow the largest area for a given optical efficiency and vice-versa; they ensure absolute uniformity of efficiency, but obviously do not show any antidirectional property; they also show considerably longer time of response, with respect to other types, but this time may be of the order of some 10^{-8} sec for a 30 cm diameter counter, which might be good enough for many purposes; oblongated forms are not advisable for this type. (auth)

5660
THE GRAIN DENSITY AND THE PROCESS OF TRACK FORMATION IN NUCLEAR EMULSIONS. III. EXPERIMENTAL DETERMINATION OF THE PROBABILITY THAT A GRAIN BE RENDERED DEVELOPABLE. M. Della Corte (Univ. of Florence, Italy). Nuovo cimento (9) 12, 28-36 (1954) July. (In English).

After some considerations on the gap-length distribution, a method is suggested by which the probability that a grain be rendered developable can be obtained experimentally. Following this scheme on the process of track formation, it is shown how it is possible to take into account the dip of the track. Application of the method to the mass identification of particles is given. (auth)

5661
ON THE CALCULATION OF GRANULES IN NUCLEAR EMULSIONS. G. Lovera (Univ. of Modena, Italy). Nuovo cimento (9) 12, 154-5(1954) July. (In Italian).

5662
COLLIMATED X-RAY BEAM FOR STUDY OF DISTORTION IN CLOUD CHAMBERS. R. S. Carter and J. C. Street (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 25, 627-31(1954) July.

A narrow, well collimated beam of soft x rays has been used for the purpose of measuring distortion in cloud chambers. The path of the x-ray beam in the cloud chamber is made visible by the ionization of the short-range photoelectrons. The main advantage of this method is that it can be used in the presence of a magnetic field. A limitation of the method is the finite width of the track. In argon it was not difficult to get a track 0.06 cm wide, allowing measurement to 0.004 cm. The appearance of the beam in both a diffusion and an expansion chamber is described. In addition to its use in measuring distortion, its applications to measuring rates of droplet growth and length of cloud chamber sensitive times are discussed. (auth)

5663
A SCINTILLATION DETECTOR FOR FAST NEUTRONS. L. W. Seagondollar, K. A. Esch, and L. M. Cartwright (Univ. of Kansas, Lawrence). Rev. Sci. Instr. 25, 689-91(1954) July.

A fast neutron detector has been prepared by suspending ZnS powder in "Bio-Plastic." The detectors can be easily prepared using only simple laboratory equipment. In the presence of the gamma rays from a Ra-Be source, the neutrons from the source can be counted using this detector with about one percent efficiency. (auth)

5664
A MULTIPLE-WIRE PROPORTIONAL COUNTER FOR FAST NEUTRON DETECTION. C. R. Sun and J. Reginald Richardson (Univ. of California, Los Angeles). Rev. Sci. Instr. 25, 691-4(1954) July.

A cylindrical chamber, 8.5 in. in length and 8.5 in. in diameter, containing two sets of parallel multiple-wire grids has been built and operated as a proportional counter for fast neutron detection. The collecting wires are 0.001 in. in diameter. Filled with pure CH_4 at about atmospheric pressure and operated at 3400 v, it serves to detect neutrons up to 10 Mev, with an average efficiency of 0.17 percent. The energy distribution of neutrons from 0.3 to 3 Mev can be estimated. The multiple-wire counter is completely insensitive to gamma radiation under these operating conditions. This instrument has been used to make a survey of fast neutrons around the U. C. L. A. cyclotron. At higher pressures the instrument can presumably be used to measure neutron spectra of higher energy. (auth)

MESONS

5665
Radiation Lab., Univ. of Calif., Berkeley
MESON MASS MEASUREMENTS. 3. THE PI-MU MASS RATIO AND ENERGY BALANCE IN PION DECAY. Wallace Birnbaum. Mar. 23, 1954. 52p. Contract W-7405-eng-48. (UCRL-2503)

The mass normalization method of measuring meson masses is extended to a determination of the positive pion-muon mass ratio. Ranges and momenta of the comparison particles produced in the 184-inch cyclotron are measured, employing the nuclear emulsion technique. The energetics of the $\pi \rightarrow \mu + \nu$ decay scheme are also studied in detail. From precise determinations of the absolute decay momentum, p_0, of the muon and the π/μ mass ratio, various meson mass and related experimental values are obtained: $m_\pi^+/m_\mu^+ = 1.321 \pm 0.002$; $p_0 = 29.89 \pm 0.07$ Mev/c; a new probable upper limit of the mass, m_ν, of the neutral decay particle of $\approx 6\text{-}7$ m_0; and a muon center-of-mass kinetic energy of 4.12 ± 0.02 Mev. With the positive pion mass value of Paper II, the m_π^+/m_μ^+ ratio yields $m_\mu^+ = 206.9 \pm 0.4$ m_0. The following values in parentheses are insensitive to m_ν and are evaluated assuming $m_\nu = 0$: $m_\pi^+ - m_\mu^+ = (66.41 \pm 0.07\ m_0)$; $m_\mu^+ = (206.9 \pm 0.2\ m_0)$ from Paper II and the mass difference; $m_\pi^+ = (273.5 \pm 1.2\ m_0)$ and $m_\mu^+ = (207.0 \pm 1.1\ m_0)$ derived solely from the pion-muon mass ratio and mass difference. (auth)

5666
RECENT RESULTS ON S-PARTICLES. H. Bridge, H. Courant, B. Dayton, H. C. DeStaebler, Jr., B. Rossi, R. Safford, and D. Willard (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (9) 12, 81-9(1954) July. (In English).

To the present time, 40 examples of S particles have been photographed with the MIT multiplate cloud chamber. Examination of the pictures has yielded the following results. In three cases the charged secondary particles were found to have ranges of the order of 100 g/cm of lead. In three additional cases the secondary particles traversed more than 70 g/cm of lead before leaving the chamber. Shorter ranges were also found, but, in interpreting these observations, the possibility of anomalous energy losses by nuclear collisions must be considered. In 9 cases an electron cascade appears to be associated

with the decay of an S particle. It is possible to interpret these events as two-body decay processes into a neutral and a charged π meson. Such a decay scheme, however, cannot explain all observed S-events. (auth)

5667
THE π^-/π^+ RATIO FROM DEUTERIUM NEAR PHOTOPION THRESHOLD. M. Beneventano, D. Carlson-Lee, and G. Stoppini (Univ. of Rome, Italy) and G. Bernardini and E. L. Goldwasser (Univ. of Ill., Urbana). Nuovo cimento (9) 12, 156-9(1954) July. (In English).

The value of the ratio $f = \sigma(\pi^-)/\sigma(\pi^+)$ of the cross sections of the reactions for the two energy-bins near the pion threshold is presented for various angles between the γ beam and the direction of emission of the π mesons. (J.S.R.)

5668
WATSON'S TYPE RELATIONS FOR Λ-PARTICLE PRODUCTION. R. Gatto (Univ. of Rome, Italy). Nuovo cimento (9) 12, 160-2(1954) July. (In English).

5669
HEAVY UNSTABLE PARTICLES IN STRIPPED EMULSIONS. J. Crussard, M. F. Kaplon, J. Klarmann, and J. H. Noon (Univ. of Rochester, N. Y.). Phys. Rev. 95, 584(1954) July 15.

A preliminary discussion of K, τ, and Λ events observed in 400- and 600-μ stripped emulsions exposed at balloon altitude at 41 and 55° geomagnetic latitude is given. (K.S.)

5670
NEGATIVE-TO-POSITIVE RATIO OF PHOTOMESONS FROM DEUTERIUM. Matthew Sands, J. G. Teasdale, and Robert L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. 95, 592-3(1954) July 15.

The ratio of negative to positive photomesons, produced by 500-Mev bremsstrahlung bombardment of D was measured at angles of 29, 73, and 140° (lab) for meson energies in the range of 0 to 200 Mev (lab). The ratio of N^-/N^+ is in the general range of 1.0 to 2.0, indicating that photoproduction of mesons is greater from neutrons than from protons. The qualitative features are predicted by pseudoscalar meson theory in weak coupling, and the determined values are larger than would be expected from nucleon magnetic coupling alone. (K.S.)

MOLECULAR PROPERTIES

5671
National Bureau of Standards
HIGH-SPEED MACHINE COMPUTATION OF IDEAL GAS THERMODYNAMIC FUNCTIONS. 2. THE DIATOMIC FREE RADICALS OF THE ISOTOPIC HYDRIDES OF OXYGEN AND SULFUR. Lester Haar and A. S. Friedman. May 31, 1954. 28p. (NBS-3314)

The partition functions for the free radicals are obtained in closed form. They include terms to account for the special low-temperature effects arising with these molecules. The splitting of the $^2\pi$ ground state is complicated by the uncoupling of the electronic spin from the nuclear axis. In addition to this effect, the partition function includes first-order corrections for rotation-vibration coupling, rotational stretching, and vibrational anharmonicity. Tables of thermal functions are computed on the NBS Eastern Automatic Computer—SEAC at 80 temperature intervals from 50 to 5000°K for OH, OD, OT, SH, SD, and ST. (auth)

5672
THERMOMAGNETIC STUDY OF THE FERRITE OF GADOLINIUM. Rene Pauthenet and Pierre Blum. Compt. rend. 239, 33-5(1954) July 5. (In French).

The susceptibility and specific magnetization of Gd_2O_3. Fe_2O_3 are investigated as a function of temperature in the range of 4 to 700°K. (K.S.)

5673
THE ELECTRONIC STRUCTURE OF THE BORIDES MB_6. H. C. Longuet-Higgins and M. de V. Roberts (Univ. of London). Proc. Roy. Soc. (London) A224, 336-47(1954) July 7.

The electronic structure of the metallic borides MB_6 is investigated theoretically by the tight-binding approximation. The stability of the crystal lattice is interpreted and it is predicted that if M is a bivalent metal the crystal should be an insulator or photoconductor, but that if M has a valency greater than 2 the crystal should exhibit metallic conductivity. These predictions are consistent with the scanty experimental evidence. (auth)

NEUTRONS

5674
Radiation Lab., Univ. of Calif., Livermore
A PULSED NEUTRON SOURCE. E. Frank Martina and Val J. Ashby. June 11, 1954. 11p. Contract W-7405-eng-48. (UCRL-4349)

A pulsed neutron source is described which gives 10^6 neutrons in a burst which is 2×10^{-8} second wide. The plasma of an ion pump is used as the source of deuterium ions which are accelerated to 200 kv before striking a deuterium target, where the $D(d,n)He^3$ reaction produces 2 to 3 Mev neutrons. (auth)

5675
NEUTRON SCATTERING AND THE WEAK-INTERACTION MODEL OF THE NUCLEUS. J. M. C. Scott (Cavendish Lab., Cambridge, England). Phil. Mag. 45, 751-7(1954) July.

Data on the scattering of slow neutrons are examined, using the theory of a previous paper, to see whether a size-resonance effect exists (of the kind which can be pictured qualitatively in terms of the crystal ball model). It is concluded that the effect is real, and that the resonances occur at the predicted values of the mass number. It is also found that a single-particle wave function for the incident neutron in the nucleus suffers less perturbation with medium weight nuclei than it does with heavy or light nuclei; there seems to be no obvious explanation. (auth)

NUCLEAR PROPERTIES

5676
[Nuclear Cross Section Advisory Group, AEC]
NEUTRON CROSS SECTION COMPILATION; SUPPLEMENT 3. Brookhaven Neutron Cross Section Compilation Group. Apr. 1, 1954. 57p. (AECU-2040(suppl.3))

Data from recent work that have reached the group since Supplement 2 was published have been evaluated and are given in the table. Where no previous values were known, the new values have been listed as "new data." In the cases where values were given in the original compilation or Supplements 1 and 2, the new data have been evaluated with the old and have been so designated in the table. When no significant change resulted from the consideration of these new data, a new value has not been listed. Values of the thermal neutron cross sections of the heavy elements have been declassified from the Classified Neutron Cross-Section Compilation, BNL-250. In addition to these changes, errors and omissions that occurred in the preparation and printing of AECU-2040 and Supplements 1 and 2 have been noted. (auth)

5677
Argonne National Lab.
CAPTURE CROSS SECTION OF Ac^{227} FOR THERMAL PILE NEUTRONS. R. K. Sjoblom and P. R. Fields. May 1954. 6p. Contract W-31-109-eng-38. (ANL-5263)

The capture cross section of Ac^{227}, irradiated in the Argonne Heavy Water Reactor (CP-3'), was determined from the ratio of Th^{228} to Th^{227}. The ratio Th^{228}/Th^{227} was measured in a differential α pulse analyzer, and the cross section was calculated from the formula

$$\sigma_{227} = \frac{Th^{228}}{Th^{227}} \frac{\lambda Ac^{227}(1 - e^{-\lambda Th^{227} t_2})}{\lambda Th^{227} \, nvt_1}$$

where t_1 = time of bombardment and t_2 = time of growth of Th^{227} since purification of the Ac. The contribution to the cross section of neutrons above thermal energies was measured to see if there was any large resonance capture. An average of 3.84×10^{12} was obtained from the pulse analysis of the Th ratio. The average thermal neutron capture cross section for Ac^{227} was found to be 516 ± 50 barns. (J.A.G.)

5678

Phillips Petroleum Co., Atomic Energy Div.
HAFNIUM AND ZIRCONIUM TOTAL CROSS-SECTION MEASUREMENTS. E. G. Joki and J. E. Evans. June 23, 1954. 7p. Contract AT(10-1)-205. (MTR-L-54-53)

The MTR crystal spectrometer was used to measure σ_t from 0.04 to 10 ev with a Hf metal sample. Measurements gave 92.4 b at 0.4 ev and 64.4 b at 0.1 ev. The new data are consistent with the tabulated thermal value of 123 ± 15 b in U. S. Atomic Energy Commission AECU-2040. The energies of the first two resonances were measured to be 1.095 ± 0.005 and 2.378 ± 0.016 ev. Single-level Breit-Wigner parameters, corrected for Doppler broadening and instrument resolution, are given. σ_t for Zr is essentially flat at 6.2 b from 0.02 to 60 ev. The sample used was 18.9 g/cm² of Zr metal, which contained 400 ppm by weight of Hf. (auth)

5679

Z DEPENDENCE OF THE PAIR FORMATION CROSS SECTIONS FOR Co^{60} GAMMA RADIATION AND THE ABSORPTION COEFFICIENT FOR ANNIHILATION RADIATION. P. Schmid and P. Huber. Helv. Phys. Acta 27, 152-5(1954) June. (In German)

The Z dependence of the pair formation cross section in Al, Fe, Cu, Cd, Sn, and Pb for Co^{60} γ radiation was remeasured and compared with the results of previous workers. The absorption coefficients for annihilation radiation for Al, Cu, Sn, and Pb are tabulated. (J.S.R.)

5680

ON THE DEPENDENCE OF THE PAIR PRODUCTION CROSS SECTIONS ON THE NUCLEAR CHARGE FOR 6-Mev γ RADIATION. H. Staub and H. Winkler. Helv. Phys. Acta 27, 223-34(1954) June. (In German).

Relative nuclear pair production cross sections have been measured for the γ rays of the reaction $F^{19}(p,\gamma)\,\alpha$, average energy 6.3 Mev, in Al, Cu, Ag, W, and Pb, by the technique of coincindence of annihilation quanta. The results show that at this energy the Bethe-Heitler formula, based on Born approximation and predicting proportionality of the cross section with Z^2, is very nearly correct. After correcting for shielding effects the cross section of lead deviates only $-2 \pm 4\%$ from the Z^2 law, in agreement with the behavior expected from absorption measurements. (auth)

5681

ON A NEW METHOD FOR THE MEASUREMENT OF RELAXATION TIMES AND ON THE SPIN OF Cr^{53}. K. Halbach. Helv. Phys. Acta 27, 259-82(1954) June. (In German).

Taking into account the finite magnitude of the modulation frequency, solutions of Bloch's differential equations are derived. They describe the signals observed on the recording instrument of a nuclear induction apparatus, and it is found that, in many cases, significant deviations from the differentiated slow passage signals appear. From the present solutions there follows a simple method for the measurement of relaxation times, which is valid even in the presence of field inhomogeneities. This is illustrated by an example. The fundamental equation for the experimental determination of the nuclear spin is likewise modified by the modulation effect. This equation is discussed and applied in the determination of the spin of Cr^{53}. The result is $I(Cr^{53}) = 3/2$. (auth)

5682

QUADRUPOLE MOMENT OF La^{139}. Kiyoshi Murakawa (Inst. of Science and Tech., Tokyo). J. Phys. Soc. Japan 9, 391-5(1954) May-June.

The hyperfine structure of the spectra of La I and La II yielded the result that the quadrupole moment of La^{139} is $(0.9 \pm 0.1) \times 10^{-24}$ cm². The construction of the light source (liquid-air cooled hollow-cathode discharge tube) is described in detail. (auth)

5683

HIGH NUCLEAR POLARIZATIONS IN PARAMAGNETIC SUBSTANCES. P. Brovetto and S. Ferroni (Istituto Nazionale di Fisica Nucleare, Sezione di Torino, Italy). Nuovo cimento (9) 12, 90-8(1954) July. (In English).

The equilibrium of nuclear polarization in paramagnetic substances is studied from the statistical viewpoint. The polarization is higher the nearer the paramagnetic resonance of the electrons is to saturation. The results obtained do not differ substantially when the electrons behave as a Fermi gas or when the Boltzmann approximation is valid. (auth)

5684

RESONANCE OF NEUTRONS IN SODIUM. D. Popović (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Nuovo cimento (9) 12, 143-4(1954) July. (In Italian).

The cadmium ratio of Na was measured relative to that of B, a known 1/v absorber. The results were $CdR_B = 48.1 \pm 0.25$ and $CdR_{Na} = 41.5 \pm 0.8$. The integral resonance absorption for Na was calculated to be $\Sigma_a = 0.037$ barn. (J.S.R.)

5685

ISOTOPIC SPIN SELECTION RULES-V: RADIATIONS FROM ^{10}B. G. A. Jones and D. H. Wilkinson (Cavendish Lab., Cambridge, England). Phil. Mag. 45, 703-11(1954) July.

The excitation function for the reaction $Li^6\,(\alpha,\gamma)\,B^{10}$ has been investigated with alpha particles of up to 1.3 Mev. States in B^{10} are found at 4.75 ± 0.02 Mev and 5.162 ± 0.008 Mev; the known state at 5.11 Mev does not appear ($\omega\gamma < \sim 0.02$ ev). This paper confines its attention to the 5.11- and 5.16-Mev states; it is concluded that the former is probably (2−), T = 0, and that the latter is (2 +), T = 1. The isotopic spin impurity of the ground state of Li^6 and the 5.16-Mev state of B^{10} combined is $\sim 6 \times 10^{-3}$; that of the 5.11-Mev state is $< 2 \times 10^{-3}$. The isotopic spin rules are violated in permitting the formation of the 5.16-Mev T = 1 state and operate in inhibiting the electric dipole transitions from the 5.11-Mev state. (auth)

5686

THE d-^{6}Li REACTIONS. F. Hirst, I. Johnstone, and M. J. Poole (Atomic Energy Research Establishment, Harwell). Phil. Mag. 45, 762-7(1954) July.

The cross sections for two of the d-Li reactions (namely $Li^6(d,\alpha)\,He^4$ and $Li^6(d,n)\,Be^7$) have been measured in the low energy range 60 to 450 kev. No evidence has been found for resonances in this region, and the branching ratio between the reactions remains substantially constant over much of the energy range. (auth)

5687

PARAMAGNETIC RESONANCE IN PLUTONYL RUBIDIUM NITRATE, AND THE SPIN OF ^{239}Pu. B. Bleaney, P. M.

Llewellyn, M. H. L. Pryce (Clarendon Lab., Oxford) and G. R. Hall (Atomic Energy Research Establishment, Harwell). Phil. Mag. 45, 773-4(1954) July.

5688

NUCLEAR SPIN AND HYPERFINE STRUCTURE INTERACTION OF THE 3.1-HR Cs^{134} ISOMER. V. W. Cohen and D. A. Gilbert (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 95, 569(1954) July 15.

Atomic beam magnetic resonance experiments on the 3.1-hr isomer of Cs^{134} give values of I = 8 (in units of $\hbar$) and $\Delta\nu$ = 3675.6 ± 0.6 Mc/sec. μ_{134m} = 1.10 ± 0.01 nm, with undetermined sign. It is concluded from these results that a mixed configuration is necessary to account for the large observed moment. Such an admixture would be 53% ($g_{7/2}$, $h_{11/2}$) and 47% ($d_{5/2}$, $h_{11/2}$), with a positive sign predicted. (K.S.)

5689

NUCLEAR SPIN AND MAGNETIC MOMENT OF 3.1 HR Cs^{134m}. L. S. Goodman and S. Wexler (Argonne National Lab., Lemont, Ill.). Phys. Rev. 95, 570(1954) July 15.

Atomic beam magnetic resonance experiments on the 3.1-hr isomer of Cs^{134} give values of I = 8 and a hfs constant of $\Delta\nu$ = 3662 Mc/sec. The magnetic moment μ_{134m} = 1.10 nm. (K.S.)

5690

DECAY OF Cs^{134m} (3.1 HR). A. W. Sunyar, J. W. Mihelich, and M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 95, 570-2(1954) July 15.

The spin assignment of 8 to Cs^{134m} reported in the two previous letters prompted a reinvestigation of the decay scheme of this isomer. Previously, a value of 7 was implicit from a direct measurement of +4 for the ground-state spin. The K conversion coefficient of the 128-kev transition was remeasured, and its E3 character confirmed. On this basis, it was assumed that the only other possible explanation for the spin inconsistency was for a hidden transition following the γ_1 line. Such a transition was found in a γ ray at 10.5 ± 0.7 kev, consisting of an M1 transition with a probable admixture of 0.5% E2. This new transition was found in coincidence with the 128-kev γ ray, and gives a sequence of spins and parities as follows: 4+, 5+, and 8−. A γ_3 cross-over transition from 8− to 4+ was found, with energy 137.4 ± 0.5 kev. (K.S.)

5691

PROTON-NEUTRON COINCIDENCES IN THE HIGH-ENERGY PHOTODISINTEGRATION OF LITHIUM. M. Q. Barton and J. H. Smith (Univ. of Illinois, Champaign). Phys. Rev. 95, 573-4(1954) July 15.

The photodisintegration of Li by 265-Mev bremsstrahlung has been found to yield coincident neutrons and protons in a definite angular correlation. A terphenyl−phenylcyclohexane neutron counter was placed behind 2 in. of Pb on the side of the beam opposite a proton telescope and the pulse-height distribution clearly indicated that only protons were in coincidence with the neutrons. It is estimated that 53% of all photoprotons from Li have a correlated neutron. These results cannot be explained by the formation of a compound nucleus, and are interpreted as support for the "pseudo-deuteron" model of Levinger. Similar effects have been noted in Be, B, C, N, and O. (K.S.)

5692

PHOTODISINTEGRATION OF DEUTERIUM BY 265-MEV BREMSSTRAHLUNG. T. Yamagata, M. Q. Barton, A. O. Hanson, and J. H. Smith (Univ. of Illinois, Urbana). Phys. Rev. 95, 574-6(1954) July 15.

The differential cross section for photodisintegration of D was measured at 45, 75, and 120° in laboratory coordinates. The experimental arrangement is described in detail, together with calibration techniques. (K.S.)

5693

NEUTRONS IN COINCIDENCE WITH HIGH-ENERGY PHOTOPROTONS. H. Myers, A. Odian, P. C. Stein, and A. Wattenberg (Massachusetts Inst. of Tech, Cambridge). Phys. Rev. 95, 576-7(1954) July 15.

Photodisintegration of C and D by 325-Mev bremsstrahlung has been investigated, and neutron-proton coincidences have been observed. These results are interpreted as removing all doubt concerning the validity of a quasi-deuteron model for the photoproton ejection process. (K.S.)

5694

SOME PILE NEUTRON CROSS SECTIONS OF ISOTOPES OF AMERICIUM, BERKELIUM, CALIFORNIUM, AND ELEMENT 99. B. G. Harvey, H. P. Robinson, S. G. Thompson, A. Ghiorso, and G. R. Choppin (Univ. of California, Berkeley). Phys. Rev. 95, 581-2(1954) July 15.

5695

TOTAL CROSS SECTIONS FOR HIGH-ENERGY NEUTRONS. Vaughn Culler and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Phys. Rev. 95, 585(1954) July 15.

A high-resolution scintillation counter telescope was designed for the accurate measurement of total neutron cross sections for Pb, Te, Si, Al, O, C, D, and H in the energy range of 61 to 108 Mev. The results are presented in tabular form. (K.S.)

5696

VALIDITY OF THE INVERSE VELOCITY LAW FOR THE FISSION CROSS SECTION OF ^{235}U. Dragoslav Popovic (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Physica 20, 406-12(1954) July.

Cadmium ratio measurements were used in order to check the validity of the $1/\nu$ law for fission of U^{235} in the resonance region. The fast fission effect was eliminated by measuring the transmission of epicadmium neutrons through nickel, which has different cross sections for resonance and fast neutrons. It was found that the $1/\nu$ law does not hold quite good in the resonance region, the resonance integral being ~ 20 barns. (auth)

NUCLEAR REACTORS

5697

North Carolina State Coll.

AN INVESTIGATION OF METHODS OF DETERMINING THE LIQUID LEVEL IN THE NORTH CAROLINA STATE COLLEGE NUCLEAR REACTOR (thesis). Claude Sidle Burnette, Jr. 1953. 73p. (AD-21666)

A study was made of various methods of measuring the liquid level within an experimental nuclear reactor. The device was required to maintain a seal throughout the reactor and to present no explosion hazard. Provision was to be made to prevent gas flow from the apparatus and to prevent gas entrapment within the device. The liquid level was to be measured over a 2-cm range and to be accurate to at least 1 mm. The following methods were considered: a Wheatstone bridge, a bubbler with fixed tubes, a differential pressure indicator, an electrical probe, a variable-depth bubbling tube, an acoustic sounder, and a variation of the acoustic sounder. The advantages and disadvantages of each type are discussed. The acoustic probe, which depended on the change in characteristics of a sound wave in an open or closed resonator tube, appeared to offer the greatest possibility for an accurate and safe method of measurement. Such a device appeared to combine the necessary accuracy without the hazard of an explosion from a spark. The acoustic probe offered the safety features of the bubbler-type probe and produced a much sharper response upon contact with the liquid surface. A working model was constructed; calculations for locating the detecting tube are appended. (ASTIA abst.)

5698
Chalk River Project (Canada)
REPORT ON ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, SEPTEMBER 9, 10, AND 11, 1953. W. J. Henderson, ed. 202p. (CRR-548-A; AECL-82)

Design problems associated with the production of electric power from nuclear reactors are reviewed in a series of papers dealing with nuclear engineering. The scope of material presented includes a discussion of all types of power reactors, but heterogeneous-D_2O reactors are emphasized. In addition to a general review of nuclear aspects, considerable data are given on the restrictions imposed by engineering and mechanical criteria. These include steam plant design and the selection of optimum steam pressures, the mechanical and nuclear properties of reactor materials, turbine design, and possible advantages in the development of gas- and liquid-metal cooling methods. (K.S.)

5699
MATERIALS FOR NUCLEAR REACTORS. Stuart McLain (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 50, 240-4(1954) May.

Materials choices for typical reactors are summarized, including source and fissionable materials, cladding materials, moderators, coolants, structural materials, shielding materials, and control elements. (L.T.W.)

5700
POWER REACTOR DESIGN FUNDAMENTALS. W. E. Abbott (North American Aviation, Inc., Downey, Calif.). Chem. Eng. Progr. 50, 245-8(1954) May.

A résumé of factors to be carefully balanced before 6-mill electric power can be achieved is presented, including cost, materials, and structure and cooling system. (L.T.W.)

5701
THE HOMOGENEOUS REACTOR EXPERIMENT. A CHEMICAL ENGINEERING PILOT PLANT. S. E. Beall and C. E. Winters (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 50, 256-62(1954) May.

The Homogeneous Reactor Experiment—a nuclear pilot plant for the production of electricity with an aqueous solution of uranium as fuel—has been operated by the Oak Ridge National Laboratory over a two-year period. The heat-producing chain reaction occurred in an 18-in. diam. sphere, and heat was removed by pumping the liquid fuel through a U-tube heat exchanger where steam was generated and fed to a small turbine-generator unit. When the reactor was operated at 1,000 kw heat output of 250° C and 1,000 lb/in.^{2}, a sufficient quantity of 200 lb/in.^{2} steam was produced to generate 140 kw of electricity. The inherent safety of the reactor, as a result of its large negative temperature coefficient, was demonstrated by increasing the power by a factor of 10^{+6} in 1 sec. Although no mechanical control devices were used, a safe equilibrium condition was reached in 100 msec. (auth)

5702
DECONTAMINATION OF THE CANADIAN REACTOR. F. W. Gilbert (Atomic Energy of Canada Ltd., Chalk River, Ont.). Chem. Eng. Progr. 50, 267-71(1954) May.

The restoration program necessitated by an accident which occurred at the Chalk River project when its reactor released into the building and equipment thousands of curies of fission products is described. Some details of the original accident are given along with an explanation of the problems and techniques. Generally, it is hoped to demonstrate that severe pile accidents need not result in hazards to personnel, either associated with the equipment or located in the surrounding district; also that such accidents need not result in complete loss of the plant, but that, through the various steps of reconstruction and decontamination, the reactor can be returned to normal operation. (auth)

5703
THE TEMPERATURE DISTRIBUTION IN A NUCLEAR REACTOR PIERCED BY CIRCULAR COOLING CHANNELS. Paul B. Richards (Case Inst. of Tech., Cleveland, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 127-33(1954).

The present study has been conducted primarily to estimate the maximum temperature in a reactor pierced by equilaterally spaced circular channels through which the coolant flows. In the course of the mathematical analysis to obtain this maximum temperature, a general method is devised by means of which the complete temperature pattern within the reactor may be determined in terms of the coolant temperature. (auth)

5704
ENGINEERING PROBLEMS PERTINENT TO THE USE OF SODIUM HYDROXIDE IN REACTORS. E. M. Simons and J. H. Stang (Battelle Memorial Inst., Columbus, Ohio). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 139-44(1954).

Anhydrous molten sodium hydroxide, because of its low vapor pressure at moderately high temperatures, rather small cross section for the capture of thermal neutrons, and substantial hydrogen content for neutron moderation, has considerable promise as a reactor liquid. It might be used as a moderator alone in an enriched reactor; as a coolant; or, with the addition of nuclear fuel in the form of a solution or slurry, as the combined fuel-moderator-coolant in a homogeneous reactor. Chemical-plant experience with anhydrous sodium hydroxide has been limited to more or less static, open systems with temperatures not much higher than 100°C above the melting point. A host of new and difficult engineering problems are encountered in the design of closed circulating systems for temperatures up to 850°C. This paper discusses some of these problems, including suitable container materials; components for high-temperature hydroxide systems, e.g., pumps, seals, bearings, valves, and plumbing; and instrumentation for such systems, including devices for measuring pressure, temperature, flow, and liquid level. Another engineering problem is that of starting up or shutting down a reactor using sodium hydroxide, which melts at 318°C. Several possible methods of charging the system and keeping the hydroxide molten are discussed. (auth)

5705
FIRST PRINCIPLES OF HEAT REMOVAL FROM NUCLEAR REACTORS. THE POSSIBLE CONFLICT BETWEEN TEMPERATURE AND POWER REMOVAL. William A. Loeb (Nuclear Development Associates, Inc., White Plains, N. Y.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 145-8(1954).

A possible conflict in the nuclear reactor field is between high coolant outlet temperature and high rates of energy removal. Behind this possible conflict lie the basic mechanisms of heat removal—heat transfer and heat transport—the interaction of which determines the extent of the conflict. Application of these principles to a particular case is outlined, and it is pointed out that solid coolants, having high volumetric specific heats, may under certain conditions prove superior to more conventional liquid coolants. (auth)

5706
TEN YEARS' OPERATING EXPERIENCE OF THE O.R.N.L. GRAPHITE-MODERATOR NORMAL-URANIUM REACTOR. M. E. Ramsey and C. D. Cagle (Oak Ridge National Lab., Tenn.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 149-57(1954).

The ORNL graphite-moderated natural-U reactor, designed to operate at 1000 kev with 4-in. long × 1.1-in. diam. slugs with 2S Al cladding for protection against oxidation at the 285°C fuel temperature normal for operation, is described. Control is maintained by monitoring the neutron intensity within the reactor and adjusting 2 horizontal steel neutron-absorbing rods either into or out of the reactor. Two horizontal and 3 vertical steel-encased Cd rods are used for planned or emergency shutdown. Start-up and operation procedures and examples of experimental uses are given. Radioactivity control and operational experiences are discussed. (J.A.G.)

5707

OPTIMIZING AND COMPARING REACTOR DESIGNS. F. T. Miles and I. Kaplan (Brookhaven National Lab., Upton, N. Y.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 159-75(1954).

Some objective criteria which can be used to evaluate and compare reactors are defined. These criteria are developed through consideration of neutron economy, fissionable-material economy, total heat rate or "power level," useful power, dollar economy, and long-range conservation of energy sources. Examples are used to show how emphasis on one criterion affects the optimum design. The change of emphasis in the past is traced, and some estimate is made of future trends. (auth)

5708

APPRAISAL OF REACTOR SYSTEMS FOR CENTRAL-STATION POWER PLANTS. Theodore Stern (Foster Wheeler-Diamond Alkali-Pioneer Service Nuclear Power Project). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 177-82(1954).

Comparison studies of reactors that can be developed to generate economic nuclear power are presented. Rules for economic analysis are discussed. Brief descriptions and economic comparisons of the pressurized-water reactor, a boiling reactor, a Na-graphite reactor, a fast Pu breeder, and an aqueous power-breeder are given. Results indicate that, with coal available at 30 cents/million Btu, none of the systems are capable of competing with a conventional steam plant. The difference in cost of power between the most nearly competitive (boiling reactor) and the least competitive (Na-graphite reactor) is 4 mils/kwh. (J.A.G.)

5709

CORROSION AND IMPURITIES IN THE HEAVY-WATER SYSTEM OF THE DUTCH-NORWEGIAN REACTOR. T. J. Barendregt and K. H. Brakstad (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). NUCLEAR ENGINEERING, PART I, Chem. Eng. Progr. Symposium Ser. No. 11, 183-7(1954).

The design and performance of the JEEP reactor is briefly discussed. Results of corrosion and impurity checks on Al canning are given. Laboratory experiments with distilled 210° water in an autoclave for 100 hr indicated that type 2S Al was the most resistant to corrosion. The corrosion effects in the reactor were mainly caused by D_2O contamination. Inspection of the valves, pumps, and heat exchanger of the D_2O system showed corrosion attacks on the stainless steel, which resulted in rust particles in the system. An increase in conductivity and decrease in the pD of the system indicated the presence of impurities. Results of an analysis of the D_2O system for impurities and causes of radioactivity after operation are given. (J.A.G.)

5710

THE SWEDISH REACTOR. Sigvard Eklund (Atomic Energy Co., Stockholm, Sweden). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 189-94(1954).

The site and building in which the Sleep Reactor is located are described. Design of the reactor (tank, U fuel rods, D_2O circulation system, heat exchanger, safety rods, power level stabilization, reactivity control, power monitoring, graphite reflector, and shielding) which is of the CP-3 type is described. (J.A.G.)

5711

SAFETY CONSIDERATIONS IN THE SELECTION OF UNIVERSITY RESEARCH-REACTOR DESIGNS AND LOCATIONS. Lawrence C. Widdoes (Univ. of Michigan, Ann Arbor). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 195-202(1954).

In the evaluation of the hazard to a given community from the location of a reactor nearby, the behavior of the reactor under all conceivable conditions must first be calculated. From these calculations the maximum credible accident can be postulated, the hazard due to the maximum credible accident examined carefully, and ways and means of restoring the facility to operation formulated. In addition to this study, the possible results of a total catastrophe should be considered. Factors used in evaluating hazards are discussed, and the results of calculations made for the location of the University of Michigan reactor on the North Campus are given. (auth)

5712

NAVAL RESEARCH LABORATORY RESEARCH REACTOR. E. H. Krause (Naval Research Lab., Washington, D. C.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 203-12(1954).

The design of a 100-kev heterogeneous NRL reactor using Al-clad U fuel elements for neutron-beam experimentation and shielding studies is proposed by combining a solid-shield research reactor and the adaptability, convenience, and bulk-shielding-study facilities of the water-moderated swimming-pool reactor. The reactor core is designed to be moved between a semioctagonal solid containing 5 beam ports, 4 exposure ports, a thermal column, and a water pool for shielding work. The general characteristics of the proposed reactor are, in addition to the above, a 3.7 Kg U^{235} critical mass, an available slow-neutron flux of 10^{12} neutrons/cm^2/sec max., a light-water or C reflector, a light-water moderator, a converted light-water coolant, 2 B plus Pb filled Al tube safety rods, 1 B plus Pb filled stainless steel tube control rod, a modified swimming-pool shell, a 12-ft water plus 3.5-ft concrete pool and a main shield of 4-in. Pb plus 5.5-ft calemanite-bearing barytes concrete for shielding, and an Al to water ratio of 0.7. The safety and control rods, shielding, control system, experimental facilities, hazards, and cost and personnel estimates are discussed in detail. (J.A.G.)

5713

A DESCRIPTION OF THE ARGONNE NATIONAL LABORATORY RESEARCH REACTOR CP-5. J. T. Weills (Argonne National Lab., Lemont, Ill.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 213-27(1954).

The Argonne Research Reactor, nearing completion, is a replacement for the heavy-water reactor. The small-core enriched-U heavy-water-moderated type reactor was approved for the research facility because of its high neutron intensity at reasonable power, because of its useful volume for experimental work, and because of its inherent safety. (L.T.W.)

5714

REACTOR DYNAMICS OF THE LOS ALAMOS WATER BOILER. Paul R. Kasten (Oak Ridge National Lab., Tenn.). NUCLEAR ENGINEERING, PART I. Chem. Eng. Progr. Symposium Ser. No. 11, 229-44(1954).

The response of the Water Boiler reactor (SUPO model) at Los Alamos, New Mexico, to sudden reactivity changes has been studied to obtain information on the power

coefficient of reactivity and to separate the effects of core-temperature rise and decomposition-gas formation upon reactor behavior. Reactivity was added to the reactor by ejecting a neutron absorber out of the core region, the effectiveness of the absorber being known as a function of absorber position, and the position known as a function of time. The reactivity added to the reactor was about 0.4% Δk_1, added in about 0.1 sec. The resultant neutron-flux deviation was measured by means of a boron-coated ionization chamber located in the graphite tamper surrounding the core. The average lifetime of prompt neutrons in the reactor was calculated from the initial prompt rise in the neutron flux and found to be about 1.7×10^{-4} sec. Following a reactivity addition, the initial rate of reactivity decrease (0.2 sec. after start) was greater than about five times the rate which could be attributed to core-temperature rise. As the gas bubbles left the core region, reactivity decrease due to core-temperature rise increased in relative importance. (auth)

5715

NUCLEAR REACTORS. K. Wirtz (Max-Planck Institut für Physik, Göttingen, Germany). Naturwissenschaften 41, No. 12, 269-77(1954) June. (In German)

The possibility of a German reactor is discussed, and the probable design characteristics are described on the basis of a comparison of numerous reactors. (J.S.R.)

5716

SOME ASPECTS OF NON-LINEAR REACTOR DYNAMICS. William Krasny Ergen and Alvin M. Weinberg (Oak Ridge National Lab., Tenn.). Physica 20, 413-26(1954) July.

The inherent stability and the character of the fluctuation in reactors which are governed by nonlinear equations of motion are discussed. Examples are presented which show how stability of reactor systems can in some cases be determined by invoking mechanical analogies and physical arguments. The discussion is concerned with disturbances of arbitrary amplitude. (L.T.W.)

NUCLEAR TRANSFORMATION

5717

ON THE REACTION $Cl^{35}(n,p)S^{35}$. H. Berthet and J. Rossel Univ. of Neuchâtel, Switzerland). Helv. Phys. Acta 27, 159-63(1954) June. (In French)

By the use of special nuclear emulsions in which AgBr was replaced by AgCl, the cross section of the reaction $U^{35}(n,p)S^{35}$ was found to be 0.30 ± 0.01 b. The distribution of protons in the plates is graphed. (J.S.R.)

5718

THE EXCITATION FUNCTION OF THE REACTION $Li^7(\gamma,p)He^6$. R. Rubin and M. Walter (Univ. of Zürich, Switzerland). Helv. Phys. Acta 27, 163-5(1954) June. (In German).

The cross section of the $Li^7(\gamma,p)He^6$ reaction was measured as a function of the gamma energy between 10 and 30 Mev. The prominent maxima were observed, one at 15.5 Mev (identical with previous measurements) and the other at 20.3 Mev. A third was indicated at 23 Mev. (J.S.R.)

5719

THE THRESHOLD OF THE PROCESS Mg(p,n)Al. H. Schneider, M. Martin, M. Sempert, and A. Sutter (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 172-3(1954) June. (In German).

The threshold of the reaction Mg(p,n)Al was determined by a proportional counter to be 5.25 ± 0.1 Mev. This result agrees with measurements made by other methods. (J.S.R.)

5720

(γ,α) AND (γ,nα) PROCESSES IN $Br^{79/81}$, $Ag^{107/109}$, K^{39}, AND S^{32}. P. Erdös, P. Jordan, J. Schmouker, and P. Stoll (ETH Zurich, Switzerland). Helv. Phys. Acta 27, 187-90 (1954) June. (In German).

5721

THE FORWARD DISPLACEMENT OF THE NITROGEN ISOTOPE OF MASS 13 PRODUCED BY BOMBARDMENT OF ALUMINIUM WITH THE ISOTOPE 14. K. F. Chackett and J. H. Fremlin (Univ. of Birmingham, England). Phil. Mag. 45, 735-41(1954) July.

The relative yields of N^{13} produced in stacked Al foils bombarded by $(N^{14})^{+6}$ ions in the Birmingham cyclotron have been studied. These show strong forward displacements of the N^{13} compared woth other radioactive products. The displacements are consistent with the hypothesis that the N^{13} is formed by a reaction analogous to deuteron stripping in which the N^{13} nuclei have a considerable proportion of the forward momentum of the bombarding ions. (auth)

5722

ELEMENT 100 PRODUCED BY MEANS OF CYCLOTRON-ACCELERATED OXYGEN IONS. Hugo Atterling, Wilhelm Forsling, Lennart W. Holm, Lars Melander, and Björn Åström (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 95, 585-6(1954) July 15.

The production of an isotope of Element 100 by 180-Mev cyclotron-accelerated $(O^{16})^{+6}$ ions bombarding U targets is reported. Measurements of the α activity of the separated isotope indicates a probable mass number of 250. Californium, produced from $(C^{12})^{+6}$ bombardment of the same target, was used as a reference element. (K.S.)

5723

ENERGY VALUES FOR SOME DEUTERON REACTIONS WITH ^{10}B, ^{11}B, AND ^{12}C. R. B. Elliott and D. J. Livesey (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A224, 129-33(1954) June 9.

With a 180° uniform field magnetic spectrometer, the following values for nuclear reaction energies have been obtained: B^{10} (dp) B^{11}, Q = 9.227 Mev; B^{10} (dα) Be^8, Q = 17.829 Mev; B^{11} (dα) Be^9, Q = 8.029 Mev; B^{11} (dα) Be^{9*}, Q = 5.598 Mev; C^{12} (dp) C^{13}, Q = 2.720 Mev. From the B^{11} (dα) Be^9 and B^{11} (dα) Be^{9*} reactions the energy of the first excited level in Be^9 has been found to be 2.431 ± 0.006 Mev. A comparison with other results of comparable accuracy is given. (auth)

PARTICLE ACCELERATORS

5724

Atomic Energy Research Establishment, Harwell, Berks (England)

PROTON ORBITS FOR AN ELECTROSTATICALLY STRONG FOCUSED 0.5 TO 5 MEV. LINEAR ACCELERATOR: 600 MEV. PROTON LINEAR ACCELERATOR. R. O. Ridley. Mar. 1954. 43p. (AERE-T/M-103)

Detailed formulas of strong focusing are presented here and possible designs of a 0.5- to 5-Mev linear accelerator are explored. Several effects cannot easily be treated analytically and are of sufficient importance to make a numerical computation desirable. The scheme of computation for the particular design chosen is described. The results are given in detail and some critical remarks are made. (auth)

5725

Atomic Energy Research Establishment, Harwell, Berks (England)

SHUNT IMPEDANCE CALCULATIONS FOR PROTON LINEAR ACCELERATORS. PART 1. W. Walkinshaw, C. S. Sabel, and S. Outram. Mar. 1954. 21p. (AERE-T/M-104)

Calculations were made for the losses in resonant-cavity linear accelerators loaded with drift tubes and operated in 2π mode and loaded with drift tubes and operated on pill boxes in π mode. It is shown that for constant drift-tube diameter and including transit time, the first type of

loading has a higher shunt impedance for protons with velocities less than 0.4c, whereas the pill box structure is better above this velocity. (auth)

5726

Atomic Energy Research Establishment, Harwell, Berks (England)

SHUNT IMPEDANCE CALCULATIONS FOR PROTON LINEAR ACCELERATORS. PART 2. W. Walkinshaw, C. S. Sabel, and S. Outram. Mar. 1954. 13p. (AERE-T/M-105)

Calculations were made as in Part I of this report but for varying diameters of drift tube operated in 2π mode and as pill boxes in π mode at a given frequency. Including a transit time factor, it is shown that the shunt impedance decreases for increasing drift-tube diameters and that, for a reasonable shunt impedance at a wavelength of 75 cm, the drift-tube diameter should be less than 10 cm. (auth)

5727

DETERMINATION OF THE AXIAL FIELD IN AN ALVAREZ LINEAR ACCELERATOR. Wassek Chahid. Compt. rend. 239, 42-4(1954) July 5. (In French).

A method is presented for calculating the electric field in a linear accelerator, taking into account the strong perturbation, introduced by accelerator tubes, on the field of simple cylindrical cavities. Agreement with experiment is near 2%. (tr-auth)

5728

A NEW ELECTRON SOURCE FOR BETATRON. E. B. Baš (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 221-2 (1954) June. (In German).

The characteristics of a new electron source for a betatron are described. (J.S.R.)

5729

A PULSED MAGNETIC EXTRACTOR FOR REMOVING THE ELECTRON BEAM FROM A BETATRON. R. S. Foote and Ben Petree (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 25, 694-8(1954) July

The electron beam of the National Bureau of Standards betatron has been removed by the use of a pulsed magnetic extractor. The electrons were spiraled outward into the extractor that had created a sharp step magnetic field canceling the betatron guiding field for 19° of azimuth. This step magnetic field was produced by a current pulse flowing in an array of parallel wires. The removed beam was well focused. Initial testing up to 24 Mev showed that about 60 percent of the accelerated electrons were extracted in the beam. (auth)

RADIATION ABSORPTION AND SCATTERING

5730

SCATTERING OF FAST NEUTRONS IN N^{14}. P. Huber and H. R. Striebel. Helv. Phys. Acta 27, 157-9(1954) June. (In German).

The scattering of neutrons by N^{14} was measured for 3.22, 3.46, 3.52, 3.65, 3.78, 3.90, and 4.14 Mev. Corrections for the background radiation and the border effect were made. (J.S.R.)

5731

INELASTIC PROTON SCATTERING IN CARBON. D. Maeder, M. Martin, R. Müller, and H. Schneider (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 166-8(1954) June. (In German).

The energy from the inelastic proton scattering in carbon $C^{12}(p,p')C^{12*} \rightarrow C^{12} + h\nu$ was measured with a scintillation spectrometer, and the total cross section for the reaction was determined. The cross sections for two proton energies were σ (4.95 Mev) = 6.8 ± 3.0 mb/sterad and σ (5.45 Mev) = 3.0 ± 1.6 mb/sterad. (J.S.R.)

5732

ELASTIC SCATTERING OF PROTONS IN COPPER. H. Schneider, M. Martin, M. Sempert, and J. Saladin (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 170-2(1954) June. (In German).

The elastic scattering of protons by Cu was measured at 6.0, 6.5, and 7.0 Mev. The results are graphed as a function of the ratio of the experimental differential cross section to the differential cross section of pure Coulomb scattering. The results are compared with theory. (J.S.R.)

5733

A COVARIANT NON-ADIABATIC EQUATION FOR NUCLEON-PION SCATTERING. J. C. Taylor (Peterhouse, Cambridge, England). Nuovo cimento (9) 12, 148-9(1954) July. (In English).

It is shown that the Neumann-Liouville iteration solution for the second-order nucleon-pion Bethe-Salpeter equation can be used as a guide of how to remove the implicit divergences in accordance with the S-matrix theory. (J.S.R.)

5734

THE ANGULAR DISTRIBUTIONS OF α-PARTICLES FROM THE $^{14}N(d,\alpha)$ REACTION AT LOW BOMBARDING ENERGIES. D. Cartwright, L. L. Green, and J. C. Willmott (Univ. of Liverpool). Phil. Mag. 45, 742-7(1954) July.

The angular distribution of the α particles from the N^{14} (d, α) reaction proceeding to the ground and first excited states of C^{12} have been studied at low bombarding energies. The results show that in the region of 21-Mev excitation energy O^{16} has states 1^-, 2^+, 3^-, but there is no state of zero spin and even parity. (auth)

5735

THE ANGULAR CORRELATION BETWEEN GAMMA-RAYS AND ALPHA-PARTICLES FROM $^7Li(p\,\gamma)\,^8Be\,(\alpha)^4He$. E. K. Inall (Australian National Univ., Canberra). Phil. Mag. 45, 768-72(1954) July.

5736

RADIATIVE CAPTURE OF ORBITAL ELECTRONS. R. J. Glauber and P. C. Martin (Harvard Univ., Cambridge, Mass.). Phys. Rev. 95, 572-3(1954) July 15.

The continuous γ spectra of Te^{55}, Cs^{131}, and Ge^{71} accompanying orbital electron capture have been found to depart from the form $x(1-x)^2$ (where $x = E/E_{max}$), obtained by the simplified assumptions of Morrison and Schiff, at low photon energies near the characteristic x-ray region. It is shown that the rapid intensity increase at low energy is predicted by treating the internal bremsstrahlung spectrum, where effects of the Coulomb field may be treated precisely. Assumptions that Coulomb effects may be neglected, and that capture occurs only from the K shell are valid only for energetic capture processes. The results of this analysis show that the spectrum of magnetic dipole radiation accompanying K capture has the form $x(1-x)^2$, and that the dominant part of the low-energy radiation is electric dipole arising from capture of electrons from P states. (K.S.)

5737

DIFFUSE SURFACE OPTICAL MODEL FOR NUCLEON-NUCLEI SCATTERING. Roger D. Woods and David S. Saxon (Univ. of California and National Bureau of Standards, Los Angeles). Phys. Rev. 95, 577-8(1954) July 15.

Preliminary results are reported on a calculation of the differential elastic scattering cross section of 20-Mev protons by medium and heavy nuclei. It is assumed that the nuclear interaction is described by a spinless, spherically symmetric, complex potential of the form $V(r) = \frac{V + iW}{1 + e^{\frac{(r-r_0)}{a}}}$, where r_0 is the nuclear radius, a determines the diffuseness of the nuclear surface, and the Coulomb interaction is taken to be that from a uniform charge distribution over a sphere of radius r_1, not necessarily equal to r_0. This potential was

chosen when trials with a square-well potential gave marked disagreement with previous experiments on heavy nuclei. Computations for Al, Ni, and Pt, using V = 38 Mev, W = 9 Mev, $r_0 = 8.24 \times 10^{-13}$ cm, and $a = 0.49 \times 10^{-13}$ cm give results very close to experimental observations. (K.S.)

5738
NEUTRON-PROTON SCATTERING AT 300 MEV. J. De Pangher (Univ. of California, Berkeley). Phys. Rev. 95, 578-9(1954) July 15.

5739
INTERACTIONS OF HIGH-ENERGY NEUTRONS IN MOLYBDENUM. E. G. Silver and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Phys. Rev. 95, 586-7(1954) July 15.

The interaction of 70-Mev neutrons with Mo has been studied by means of a technique using 28-μ Mo wires embedded in a G5 nuclear emulsion. A range histogram of the singly-charged particles originating in the Mo was contructed, and two peaks of energy 3 and 6 Mev were found. The number of total particles per unit solid angle was plotted vs. spatial angle, with this histogram including the results for singly and doubly-charged particles. (K.S.)

5740
POLARIZATION OF NUCLEONS ELASTICALLY SCATTERED FROM NUCLEI. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 95, 587-9(1954) July 15.

Previous calculations of the polarization of nucleons elastically scattered from nuclei, using a square-well potential, do not give support to an oscillatory behavior of the polarization. It was suggested that oscillatory behavior may be directly connected with the assumption of a sharp nuclear boundary and might disappear for a nuclear potential with a more progressive falloff near the nuclear radius. In this paper, the harmonic oscillator potential $V = V_0(1-r^2/R^2)$ was used in these calculations. Results are presented for 316-Mev protons scattered from Be. (L.T.W)

5741
NUCLEAR SCATTERING OF GAMMA RAYS BELOW MESON THRESHOLD. G. E. Pugh, D. H. Frisch, and R. Gomez (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 95, 590-1(1954) July 15.

An energy-sensitive γ-ray detector was used to measure the γ-ray scattering cross section of Be, C, Al, Cu, Sn, Pb, and Bi at 90 and 135°. Curves were computed for a uniform distribution of protons in nuclei of radius $R = R_0 A^{1/3} \times 10^{-13}$ cm, using the classical Thompson individual-proton cross section (σ_p^0(Thompson) = $\frac{1}{2}(e^2/mc^2)^2(1 + \cos^2\theta)$) and the results point to $R_0 = 1.1 \pm 0.2$. Discrepancies were observed in the lighter elements, and the ratio of $\sigma^0(n+p)$ to σ_p^0 (Thompson) is plotted as a function of energy. The anomalous effects shown in this plot suggest that they may be considerably quenched in the heavy elements. (K.S.)

5742
SMALL-ANGLE NEUTRON-PROTON SCATTERING AT 400 MEV. A. J. Hartzler, R. T. Siegel, and W. Opitz (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 95, 591-2 (1954) July 15.

Previously reported n–p scattering measurements (Phys. Rev. 95, 185(1954)) at 400 Mev have been extended to neutron scattering angles below 40°. Since proton recoil energies in this region are too low for counting directly, an arrangement was designed for observing the scattered neutrons. A liquid–H and polythene scatterer were used, and the results are presented in tabular form. A slow angular dependence of the cross section for small θ was found, and this result, together with the rapid variation near 180°, are in qualitative agreement with other cloud-chamber work at 300 Mev, but indicate a change from the symmetry about 90° observed at 90 Mev. (K.S.)

5743
POLARIZATION PHENOMENA OF ELECTRONS AND PHOTONS. II. RESULTS FOR COMPTON SCATTERING. F. W. Lipps and H. A. Tolhoek (Johns Hopkins Univ., Baltimore, Md.). Physica 20, 395-405(1954) July. (cf. NSA 8-3627).

The Compton cross section is given, including all polarization details. The use of the 3-dimensional polarization vectors ξ and ζ, for photons and electrons, makes the results very explicit, so that any specific polarization effect can easily be obtained from the general formula. A special discussion and numerical results are given for the following polarization effects: the detection of circularly polarized gamma radiation by Compton scattering from magnetized iron; the production of polarized electron beams by incident circularly polarized gamma radiation; and the production of polarized electron beams by scattering unpolarized gamma radiation from magnetized iron. (auth)

5744
ANGLE-ENERGY DISTRIBUTION OF RADIATION FROM HIGH-ENERGY ELECTRON ACCELERATORS. R. M. Warner, Jr., and E. F. Shrader (Case Inst. of Tech., Cleveland, Ohio). Rev. Sci. Instr. 25, 663-7(1954) July.

An energy-analyzing detector of the pair-spectrometer type has been used to observe the angular distribution of bremsstrahlung produced by 17-Mev monokinetic electrons in molybdenum betatron targets. Distributions were measured for gamma-ray energies of 7, 11, and 15 Mev, for each of three targets whose thicknesses were approximately 2, 5, and 21 mils. Reproducible variations of spectrum with angle were found, the variations becoming more pronounced with increasing target thickness. The experimental distributions are compared here with the theoretical distributions of Schiff and Lawson, the former being significantly narrower. Axial relative spectra are also presented. (auth)

RADIATION EFFECTS

5745
ON THE DIFFERENTIAL CONDUCTIVITY-EXCITATION OF CdS CRYSTALS BY α PARTICLES. Walter Kolb (Physikalisches Institut der Technischen Hochschule, Karlsruhe, Germany). Ann. Physik. 14, 397-411(1954) June. (In German).

On thin CdS single crystals, the magnitude of the current impulse generated by α particles was determined. At high field strengths the impulse height is a measurement of the number of charge carriers excited by an α particle. The trend of the differential conductivity–excitation as a function of the rest state range was determined qualitatively with a Bragg curve measured in air. The crystal showed no intensifying effect, but at high field strengths saturation occurred. The impulse height is dependent on the radiation direction at low field intensity. (tr-auth)

RADIOACTIVITY

5746
Rensselaer Polytechnic Inst.
INVESTIGATIONS ON Cs^{137} (thesis). William E. Kinney. Sept. 1953. 47p. (AECU-2921)

As a test of the R.P.I. beta ray spectrometer, and in an attempt to gain information, some of the radiations of Cs^{137} and Au^{198} were studied. The internal conversion spectrum of Cs^{137} was investigated and its gamma ray energy was measured by comparison with the Hg^{198} K line. It is found, for the Ba^{137} spectrum, $K/L = 5.43 \pm 0.05$, $M/L = 0.27 \pm 0.01$, $L_I/L_{III} = 8 \pm 2$, the M line is predominantly M_I, and the

gamma-ray energy is 660.79 ± 0.27 kev. It is concluded that a systematic error enters into the instrument for measurements over large energy ranges (1000 gauss-cm) but that small range measurements (150 gauss-cm) and ratio measurements can be trusted. The Hg^{198} L line is thought to be predominantly L_I. (auth)

5747

Ames Lab.

THE HALF-LIVES OF SOME SHORT LIVED LOW Z NUCLEI FORMED BY PHOTONUCLEAR REACTIONS. Philip Phipps and D. J. Zaffarano. Dec. 1953. 29p. Contract W-7405-eng-82. (ISC-443)

The half lives of several members of the "mirror" nuclei series have been measured, using improved scintillation counter detectors and a cycling apparatus which programs the synchrotron beam and several subsequent gated detectors in sequence repetitively. By the use of beta-ray energy discrimination, least squares fitting of decay curves, and by careful correction for background activities, the improved values listed were found.

Summary of Half-lives Measured

Mg^{23}	10.7 ± 0.7 seconds
S^{31}	2.40 ± 0.07
K^{37}	0.98 ± 0.02
Si^{27}	4.05 ± 0.10
Na^{21}	22.9 ± 0.4

(auth)

5748

THE TOTAL DISINTEGRATION ENERGY OF THE NUCLIDE Na^{25} AND MAGIC NUMBER 14. Maurice E. Nahmias and Tosiko Yuasa. Compt. rend. 239, 47-9(1954) July 5. (In French).

5749

THE RADIOACTIVE CONVERSION OF THE 1-MIN Na^{25}. D. Maeder and P. Stähelin (ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 168-70(1954) June. (In German).

The β and γ spectra from the conversion $Na^{25} \rightarrow Mg^{25}$ were studied with a scintillation spectrometer. The intensity of the γ lines found at 390, 580, 970, and 1600 kev had the relationship 7:9:18:7. The total energy of the β spectrum for single impacts was 3.8 ± 0.2 Mev and 2.9 ± 0.2 Mev for β particles in coincidence with the γ radiation. (J.S.R.)

5750

THE NATURAL RADIOACTIVITY OF LUTETIUM. D. Dixon, A. McNair, and S. C. Curran (Univ. of Glasgow). Phil. Mag. 45, 683-94(1954) July.

The radiations from the decay of naturally occurring Lu^{176} are studied in detail. The β^- spectrum, which was found to be of allowed shape, was investigated using internally mounted sources of thickness 0.49 mg/cm^2 and 0.149 mg/cm^2 in a well-shielded proportional tube spectrometer. A half life of $4.56 \pm 0.3 \times 10^{10}$ years was obtained for the β transition with a maximum energy of 425 ± 15 kev and the log ft value, 18.75, suggests a 3rd or 4th forbidden transition. Strong electron peaks arising from the internal conversion of an 89-kev γ ray were observed and a K-capture branching ratio of 3 ± 1% is derived from a study of the intensity and nature of the L x rays accompanying the disintegrations. NaI scintillation counters were used for the measurement of γ rays of energy 310 ± 10 kev and 190 ± 10 kev and the evaluation of their internal conversion coefficients classifies them as E.Q. transitions. The intensities of the γ quanta and the occurrence of γ-γ coincidences conclusively establish the decay scheme as suggested by Goldhaber and Hill, in which the β^- transition is followed by the γ rays in cascade. The energies and character of the γ ray transitions are in close agreement with those predicted from the Bohr-Mottelson rotational model of the nucleus (Bohr and Mottelson 1953). (auth)

5751

GAMMA RAYS FROM THE $Si^{29}(p,\gamma)P^{30}$ REACTION. P. M. Endt, J. C. Kluyver, and C. Van Der Leun (Physisch Laboratorium der Rijksuniversiteit, Utrecht, Netherlands). Phys. Rev. 95, 580(1954) July 15.

Gamma-ray and energy-level measurements of P^{30} are reported. Spin and parity assignments are made on the basis of the observed results. (K.S.)

5752

SEARCH FOR A 56 KEV γ-LINE AND THE K CONVERSION OF THE 165 KEV LINE IN ^{139}Ba. R. H. Nussbaum and R. van Lieshout (Instituut voor Kernphysisch Onderzoek, Amsterdam, Netherlands). Physica 20, 440(1954) July.

Heydenburg and Temmer (Phys. Rev. 93, 906(1954)) reported a 56-kev γ ray from Coulomb excitation of La^{139} with 3-Mev α particles, which was ascribed to the de-excitation of a 56-kev level in this nuclide. In the present paper a reinvestigation of the γ-ray spectrum of Ba^{139}, which decays by electron emission into La^{139}, is reported in order to get more information about this hitherto unknown state. Only a 165 ± 2-kev line and the La K x radiation due to its conversion were found. The 56-kev γ ray of La^{139} was not found. (L.T.W.)

SHIELDING

5753

MARBLE USED AS A RADIATION SHIELD Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Available from the Marble Institute of America, 108 Forster Ave., Mt. Vernon, N. Y., 31p., 1954.

The economical advantages of marble used as a radiation shield instead of Pb, concrete, or another of the more common materials are discussed. Measurements of the absorption of high energy γ rays in marble are compared with the absorptive properties of other materials. (J.S.R.)

SPECTROSCOPY

5754

HYPERFINE STRUCTURE OF THE SPECTRUM OF RUTHENIUM. PART II. Kiyoshi Murakawa (Inst. of Science and Tech., Tokyo). J. Phys. Soc. Japan 9, 427-8 (1954) May-June.

THEORETICAL PHYSICS

5755

DEFINITIONS AND ANALYTIC PROPERTIES OF R AND S MATRICES ASSOCIATED WITH TENSOR FORCES. II. CASE OF THE S MATRIX. Williams Laskar and Marcos Moshinsky. Compt. rend. 239, 29-31(1954) July 5. (In French).

5756

A MESON EFFECT IN THE DIPOLE SELECTION-RULE IN SELFCONJUGATE NUCLEI. G. Morpurgo (Univ. of Rome, Italy). Nuovo cimento (9) 12, 60-80(1954) July. (In English).

An effect is described by which a well known selection rule for emission of dipole radiation in a transition between two levels having the same charge parity (or isotopic spin) in selfconjugate nuclei may be weakened. The effect depends on the fact that the total momentum of the nucleons plus the momentum associated with the fluctuations of the mesonic field in a nucleus is a constant of the motion but not the total momentum of the nucleons only, while this last circumstance is assumed in the usual derivation of the selection rule. The factor of weakening has been calculated and turns out to be of the order (in amplitude)

$(g^2/4\pi)(\mu/Mc^2) \cong U/Mc^2$, where U is some average potential energy in the nucleus, M the mass of a nucleon, and μ the inverse Compton wave length of a meson. This is the same order of magnitude as the one due to Coulomb impurity. If it will be possible with an increasing experimental accuracy to separate at least for some transition the mesonic effect from the Coulomb one, this would furnish a direct experimental proof for the existence of virtual mesons in a nucleus or, in other words for a relativistic (meson) theory of nuclear forces. (auth)

5757
ON THE HYDRODYNAMICAL MODEL OF QUANTUM MECHANICS. M. Schönberg (Univ. of São Paulo, Brazil). Nuovo cimento (9) 12, 103-33(1954) July. (In English).

A new hydrodynamical model for the Schroedinger equation is discussed. The new model differs from that of regular letters by the existence of turbulence. It follows directly from the ordinary interpretation of quantum mechanics by the introduction of operators for the charge and current densities and the components of the stress tensor in the one-particle formalism. The model is developed for any values of the spin. The Madelung fluid corresponds to the mean motion of the special turbulent medium. The quantum potential appears as a combination of a pressure with terms arising from the turbulence. It is shown that the quantization of the motion of the Madelung fluid introduces the right kind of turbulence. The trajectories of the de Broglie-Bohm theory appear as trajectories of the mean motion of the turbulent medium. (auth)

5758
ON THE NUCLEAR TEMPERATURE. A. Tomasini (Univ. of Bologna, Italy). Nuovo cimento (9) 12, 134-9(1954) July. (In Italian).

Some experiences of nuclear evaporation are discussed, and it is shown that by interpreting them with Weisskopf's formula the results agree fairly well. (auth)

5759
P-WAVE PION NUCLEON SCATTERING BY VARIATIONAL METHOD. L. Sartori (Univ. of Turin, Italy) and U. Wataghin (Istituto Nazionale di Fisica Nucleare, Milan, Italy). Nuovo cimento (9) 12, 145-7(1954) July. (In English).

The P-wave phase shifts in pion-nucleon scattering were calculated using the extended source approximation and the variational method developed by Cini and Fubini (Nuovo cimento (9) 11, 142(1954)). The results fitted the P-wave part of the Glicksman set of phase shifts. (J.S.R.)

5760
ON THE RELATION BETWEEN CERENKOV RADIATION AND BREMSSTRAHLUNG. J. D. Lawson (Atomic Energy Research Establishment, Harwell). Phil. Mag. 45, 748-50 (1954) July.

5761
A NOTE ON THE DIVERGENCE OF THE PERTURBATION METHOD IN FIELD THEORY. S. F. Edwards (University of Birmingham, England). Phil. Mag. 45, 758-61(1954) July.

After certain approximations are made, the divergence of the perturbation series expressing the radiative corrections to the motion of a nucleon is related to the divergence of the Born approximation to the motion of a bare nucleon in a given field. (auth)

5762
STATISTICAL MECHANICS AND THE OVERHAUSER NUCLEAR POLARIZATION EFFECT. C. Kittel (Univ. of California, Berkeley). Phys. Rev. 95, 589-90(1954) July 15.

Overhauser (Phys. Rev. 92, 411(1953)) has discovered that under appropriate conditions the population distribution of nuclear spins in a metal among the nuclear magnetic sublevels is determined essentially by the magnitude of the electronic magnetic moment rather than by the nuclear moment. In this note the connection of this result with the general principles of statistical mechanics and with the second law of thermodynamics is established. (L.T.W.)

5763
FIELD EQUATIONS IN FUNCTIONAL FORM. S. F. Edwards and R. E Peierls (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A224, 24-33(1954) June 9.

Starting from the functional equations governing Green's function of a single nucleon moving in an external field with radiative corrections, as given by Schwinger, a formulation is developed which relates this function to that of a nucleon moving in an arbitrary external field, without radiative corrections. In the case of neutral scalar meson theory in which the recoil of the nucleon is neglected, Green's function is obtained in closed form. Mass and Green-function renormalizations are easily done completely, and the singularities of the solution investigated, proving to be an interesting illustration of the expected behavior in more realistic cases. (auth)

URANIUM AND URANIUM COMPOUNDS

5764
MEASUREMENT OF THE RATIOS OF THE α-ACTIVITY OF U^{235} AND U^{234} IN NATURAL URANIUM. E. Baldinger, P. Huber, K. P. Meyer, and E. Würger. Helv. Phys. Acta 27, 150-2(1954) June. (In German).

The ratio of the α activity of U^{235} and U^{234} in natural U was remeasured using an ionization chamber filled with 6 atm. of A + 0.5% CO_2. The ratios were calculated to be $V(U_I^{235}/U^{234}) = 4.09 \pm 0.07\%$ and $V(U_{total}^{235}/U^{234}) = 4.77 \pm 0.09\%$. (J.S.R.)